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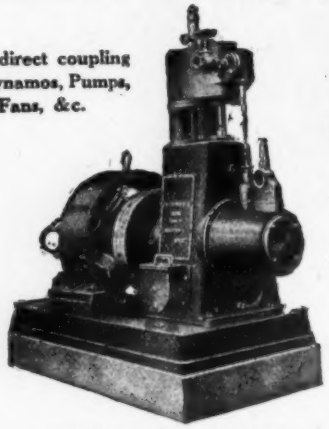

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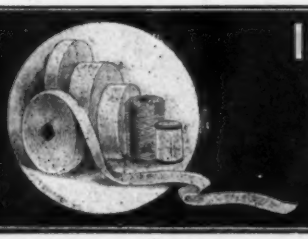

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ELECTRICAL REVIEW.

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LONDON'S ELECTRICITY SUPPLY.

THE publication of the decision of the Electricity Commissioners with regard to electricity supply in the London and Home Counties District cannot be regarded as other than an important event. The details are recorded elsewhere in this issue.

In commenting on the subject, our thoughts travel back to the equally epoch-making decision of the Board of Trade, following the inquiry held by Major Marindin in 1889, which presents a startling contrast with the trend of policy to-day. In those early days, when the great future of electricity as a factor in the life of the community was hardly guessed at, the Government was keenly on the alert to checkmate the supposed rapacity of private undertakers, and to foster municipal trading; consequently the Board of Trade set its face rigidly against co-operation, and decreed that as far as possible a.c. and d.c. supply should be provided in every street where mains were laid, with a view to ensuring that competition should operate to bring down prices and prevent the companies from making large profits.

No more wasteful or inefficient course could have been conceived; more than anything else, this policy operated to perpetuate a multiplicity of systems of supply and to increase the difficulty of unification, whilst it also hampered the companies and seriously delayed the development of electricity supply in this country.

Now, at last, common-sense views prevail, and it is recognised that co-operation, unification, concentration, and freedom from competition are essential to the free and generous expansion of the electrical service. We can never hope to share in the advantages of a unified supply such as that of Chicago, but the policy of the authorities is set in the right direction, and in the distant future our descendants may enjoy those benefits.

The Commissioners have decided to set up a Joint Electricity Authority for the District, on which all interested parties will be represented (not, as stated in the *Daily Mail*, local authorities only—a serious mistake), and have approved of the technical proposals for dealing with the requirements up to about 1926; but with regard to the second stage, up to 1930, they prefer to install the additional plant, estimated at 199,000 kW, in a new capital station or stations on the riverside, which they believe would make for economy of capital outlay and running costs, representing an annual saving of more than £1,000,000. As immediate steps must be taken to commence work on the first new station, the Commissioners propose to authorise the County of London Electric Supply Co., Ltd., to proceed with its erection on the Barking site. They also favour the proposal to extend the tenure of the distributing powers held by the supply companies, coupled with a sliding scale of price and dividend. The rights of the Metropolitan and the North Metropolitan Electric Supply Companies will be respected, and they will be authorised to carry out the work of the Joint Authority in their respective areas.

On the whole, we think that the course adopted by the Commissioners represents a very satisfactory provisional solution of the difficult and complicated problem which confronts them, and tends to make the best use of the existing plant, whilst paving the way to the ultimate goal upon which the Government turned its back 30 years ago; but it must be regarded as only provisional, for the Commissioners have no compulsory powers, and the scheme is not only unworkable without further statutory powers, but is dependent upon acceptance by the various electricity supply undertakers con-

cerned. Unfortunately, in at least one quarter, that acceptance has already been definitely withheld. Writing to *The Times* on December 15th, Mr. W. F. Fladgate, chairman of the London Electricity Joint Committee, 1920, Ltd., on which nine companies are represented, stated that his board could not accept the plan outlined by the Commissioners. The companies, he said, had laid down the condition at the inquiry, as necessary for their taking part in a Joint Electricity Authority, "that the whole of the financial control of the Authority's work should be in the hands of those members of that body who provided the necessary capital." The Commissioners' scheme not only ignored this stipulation, but would commit the Authority to heavy capital expenditure, and Mr. Fladgate's Committee declined to undertake financial responsibility under such conditions. Negotiations were still in progress with the London County Council with a view to arriving at an amicable arrangement on the question of purchase, and the Committee had even prepared a Bill to facilitate the joint action of all the undertakers within the district; but that measure would now be withdrawn.

It is exceedingly regrettable that so serious a hitch should have arisen. The refusal of the companies to provide capital for other people to spend is readily understood; but any measure of co-operation necessarily involves the sacrifice of some portion of one's independence of action and freedom from control, and the companies were not asked to come in without compensation in the shape of extension of tenure. We cannot pass judgment upon their attitude in the absence of details, and we will not suggest that it is partly due to pique at the evident success of the County of London Company—we believe that the companies are as anxious as anyone to arrive at a satisfactory solution of the question, and we hope that as the result of their protest they will obtain from the Commissioners such assurances as will enable them to carry on. It should be observed that the Commissioners intend to invite the comments of all parties represented at the inquiry on the clauses of the Draft Order, and it may prove to be a matter for regret that the Joint Committee has embarrassed them by rushing into print.

ELECTRICITY IN MINES.

The coal industry—like most other industries—is in a bad way, due mainly to the ignorance of our Trade-Union leaders of economic law, and to the practice of false doctrines by trade unionists in general. The total earnings of any industry are limited to the output, multiplied by the price obtainable for the products, and these earnings are divided between Capital and Labour, the latter *always* obtaining the larger share. Now, suppose Labour makes demands, which will not only absorb all the share due to Capital, but will, moreover, increase the price to such an extent that customers cannot afford to buy, there is an end to the industry; and this is what has nearly happened to our coal industry.

What has enabled wages to be increased and hours of labour to be reduced is the enormous introduction of labour-saving machinery due to the inventive capacity of the engineering profession and the genius of organisation of our great managers of industry. All that trade unionism has ever done is that it, to some extent by its demands, has stimulated the latter to find means to produce the wherewithal to satisfy those demands, and the credit is due mainly to the brains of the engineers, inventors, and managers, who have made use of capital to such good advantage that the worker has benefited. In the coal mining industry in particular the worst evil of trade unionism at the present time is the terrible demoralisation of its members; the insistence on a *minimum wage* is actually a curse to the individual who believes in and accepts it. The incidence of the minimum wage, and the reduction of hours from eight to seven per diem, have so raised the cost that the industry has almost come to a standstill.

All the strikes in the world cannot obtain for the worker one penny more, if that penny cannot be obtained in the operation of the industry. And now the only hope for the coal industry lies not with the Miners' Federation of Great Britain, but with the managers and engineers engaged in the direction and operation of the collieries, and we have no hesitation in saying that the restoration of the industry to renewed prosperity will be due mainly to the greatly extended use of electricity in reducing operation costs. In fact, were it not for the electrical machinery already in use in our mines, there would be fewer collieries working to-day, and very many more miners would be out of employment. From the General Report of H.M. Chief Inspector of Mines (p. 847) we see that the increase in the use of electricity steadily goes on, but whereas the increase in 1919 amounted to 6.58 per cent., in 1920 it was only 5.04 per cent. Probably for the present year it will be even less, due to the very unfortunate strike with its disastrous results. In 1910 there were approximately 2,000 coal-cutting machines at work (all types), in 1920 there were more than 5,000. In 1910 about $5\frac{3}{4}$ per cent. of the total coal output was obtained by means of machinery; in 1920 this had increased to nearly 13 per cent. In 1919 the total electrical horse-power in use in mines was 1,028,927, being an increase of 6.58 per cent. on the previous year; in 1920 this had further increased to 1,080,822 h.p., or an increase—as previously mentioned—of 5.4 per cent., and the great proportion was in underground machinery. Again, to prove the advantage of the electrically-driven machines, it is important to notice that whereas in 1920 less than 5 per cent. of the coal output was obtained by compressed-air-driven machines, over $9_{\frac{1}{2}}$ per cent. was obtained by electrically-driven machines. Electricity enters into practically every operation of colliery working—winding, ventilation, coal cutting, haulage, pumping (the latter to the extent of nearly one quarter of the total), lighting, and shot-firing. The use of electric safety lamps increased from 197,722 in 1919 to 245,000 in 1920, and no fewer than 28,387,259 shots were fired electrically, by means of a portable shot-firing battery or magneto. All this undoubtedly proves the enormous influence of the use of electricity in enabling the mines to be worked, and coal to be sold at a price that people can afford to pay, and the miner to be kept employed.

The Gasfilled Lamp Patent.

At last the question whether the British patent for the gasfilled lamp is sound or not has been settled by the final court of reference—the House of Lords; the verdict of two lower Courts has been reversed, and the validity of the patent has been affirmed. The question being no longer *sub judice*, comment is permissible, and we feel bound to say that in our opinion, if ever there was a case in which inventive ability and perspicacity in research were displayed in their highest development, the invention of the gasfilled lamp by Dr. Langmuir was that case. The researches which led up to it have been described in our pages; they were of the type known as "industrial research"—*i.e.*, research with a definite commercial purpose—as distinguished from "scientific research," which is taken to mean research prosecuted for its own sake alone, to add to the sum of knowledge, without an immediate commercial objective.

While the upholding of the patent is of immense importance to its owners, we think that no one will grudge them their due reward for a most remarkable and successful achievement; through the operation of the lamp-makers' agreement, we take it that British lamp-makers will have the use of the patent on reasonable terms. But we hope the moral of the affair will not be lost upon British manufacturers of every description—namely, that unless they carry out researches themselves, they will be dependent upon discoveries made abroad; and the nation that lags behind in the industrial race neither commands nor deserves prosperity.

ELECTRICITY SUPPLY AT CHESTER.

BULK SUPPLY FROM QUEEN'S FERRY.

There is one bright spot in that huge collection of now derelict buildings known as H.M. Factory, Queen's Ferry, formerly an important T.N.T. producing centre—and that is the power house, which, since December 9th, has been fulfilling a peace-time service for the ancient City of Chester. For several years the generating plant at the hydro-electric works and at the New Crane Street station of the Chester Corporation has been overloaded, and owing to the difficulty of obtaining plant at the required time, the Electricity (Supply) Act of 1919, and the formation of the Chester and North Wales Electricity District, it became necessary to discover new sources of supply. In August, 1919, negotiations were inaugurated for the acquirement of electricity supplies from H.M. Factory, Queen's Ferry, and Friday fortnight saw the consummation of those efforts.

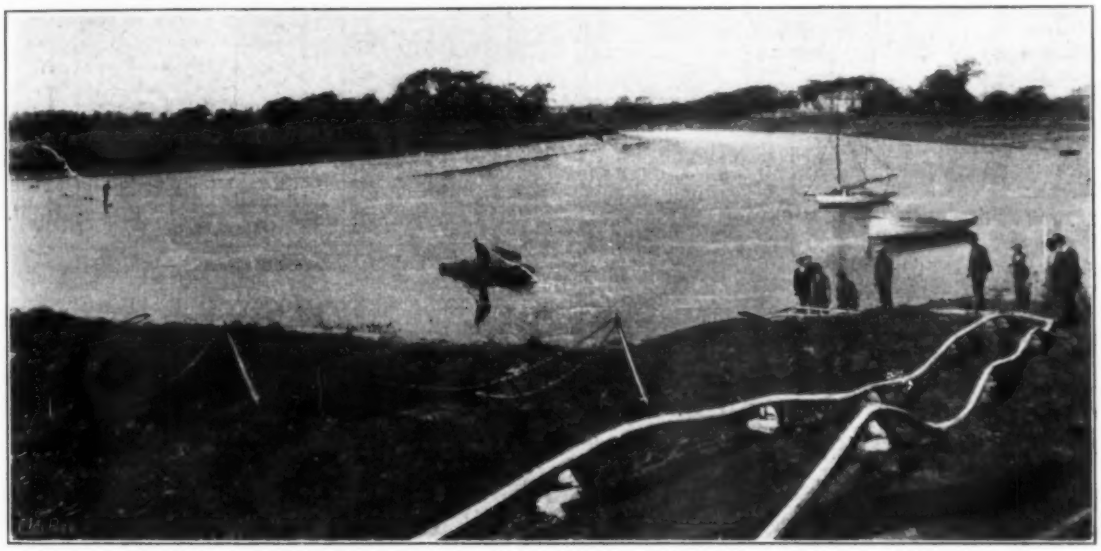
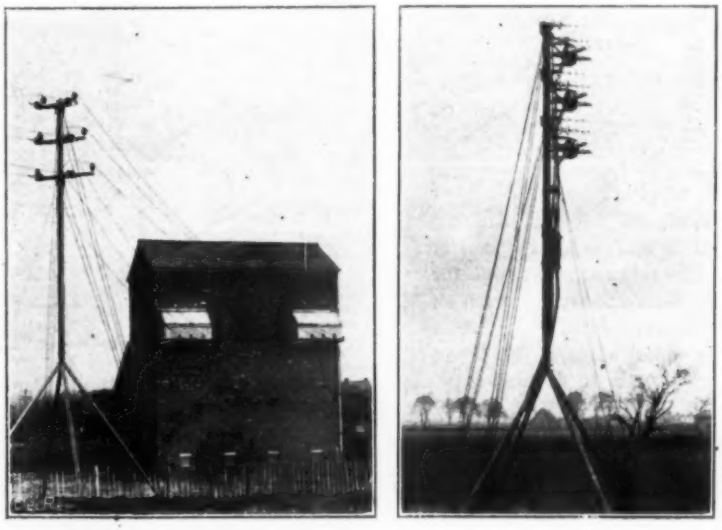


Fig. 1.—Duplicate 33,000-V Cables Crossing the River Dee.

The present scheme involved the following desiderata: increasing the available supply without, in view of prospective developments in the North Wales district, involving too great an expense in plant. The expenditure was £52,000. The existing steam-driven station at New Crane Street and the hydro-electric station on the River Dee are both d.c. stations. Consequently, it was desired to retain the local d.c. distribution scheme, but yet have the facilities which h.p. alternating current gives for transmission purposes in view of applications being received from outlying districts for a supply of power.

Although the distance between Queen's Ferry and Chester is only six or seven miles, it was decided to transmit the power at a pressure of 33,000 volts, the idea being that this short-length transmission line would be finally merged into the network of the North Wales and Chester Electricity District as delimited by the Electricity Commissioners. At Chester the line voltage is transformed down to 6,600 volts for power supply to the neighbouring areas and for use on rotary converters running in parallel with the existing steam and water stations on the d.c. side.

A 440-volt bulk supply and metering panel was installed at the Queen's Ferry power station for the control of the 2,200-kVA step-up transformer. This panel is a standard black-enamelled slate panel equipped with a 3,000-amp. l.p. automatic oil circuit breaker and with indicating and integrating meters; the integrating wattmeter is fitted with a Merz maximum-demand indicator, with a 15-minutes' resetting period. The design of the panel is similar to that of the panels of the existing Queen's Ferry switchboard, fig. 8, thus giving a uniform appearance to the station, but the panel is mounted as a separate unit, and not as an extension to this switchboard.



Figs. 2 & 3.—Terminal Poles and Bumpers Lane Sub-station.

The transformers at Queen's Ferry and Bumpers Lane are 2,200-kVA, 3-phase, units, star-connected on the

33,000-volt side and delta-connected to the 440 and 6,600-volt circuits. They are designed for indoor mounting, and are fitted with rollers for convenience when moving them about; the core-type method of construction has been adopted, with cruciform section cores and circular coils. This method of construction lends itself to a very robust design, and simplifies the insulation problem of the h.p. windings. Special provision is made in the coil supports for automatically taking up any shrinkage of the insulation due to pressure of the windings and the influence of the hot oil; the device, whilst taking up the shrinkage of the insulation, avoids the possibility of vibration or movement of the coils being caused by sudden loads on the system. The insulation of the end turns of the 33,000-volt windings has been reinforced to withstand voltage stresses which may be caused by atmospheric disturbances or switching conditions, and the unit is contained in a boiler-plate tank fitted with external circulating and cooling pipes.

FIG. 4.—KALANITE 33,000-V END-STRAIN INSULATOR.

Isolating links are provided at both ends for disconnecting either overhead line or any of the cables; the substation was erected specially for this scheme, and allows for the accommodation of an additional transformer at a later date when it is found necessary to increase the demand on Queen's Ferry.

The main 6,600-volt distribution board at the New Crane Street generating station is equipped with oil circuit breakers, isolating switches, and instruments for controlling one incoming and three outgoing circuits. On account of the limited space available in the station, the board was so constructed that it could be placed directly against the station wall and access obtained to the interior of the cubicles from the front. Two of the circuits are outgoing feeders to the neighbouring districts, whilst the remaining feeder supplies a rotary converter in the station itself. One of the outgoing feeders was already giving a bulk supply to Saltney at 6,600 volts previous to the installation of the present plant. This was obtained by means of a 250-kW rotary converter, which was run inverted from the d.c. busbars. This machine will now be connected up to the 6,600-volt bars, and used for light load or emergency services when necessary. The second outgoing feeder gives a bulk supply to Messrs. Brook, Hirst & Co., Ltd., and the Hydraulic Engineering Co., Ltd. At each substation a 500-kW rotary converter is installed to convert the supply from 3-phase, 6,600 volts to one of 440/480 volts d.c. on a 3-wire system, and the machines are arranged to run in parallel with the existing d.c. supply at these works. The incoming supply is controlled by a self-supporting sheet-steel cubicle equipped with the necessary oil circuit breakers and indicating instruments. At both the power and sub-stations a separate panel controls the d.c. supply from the machines to the existing busbars.

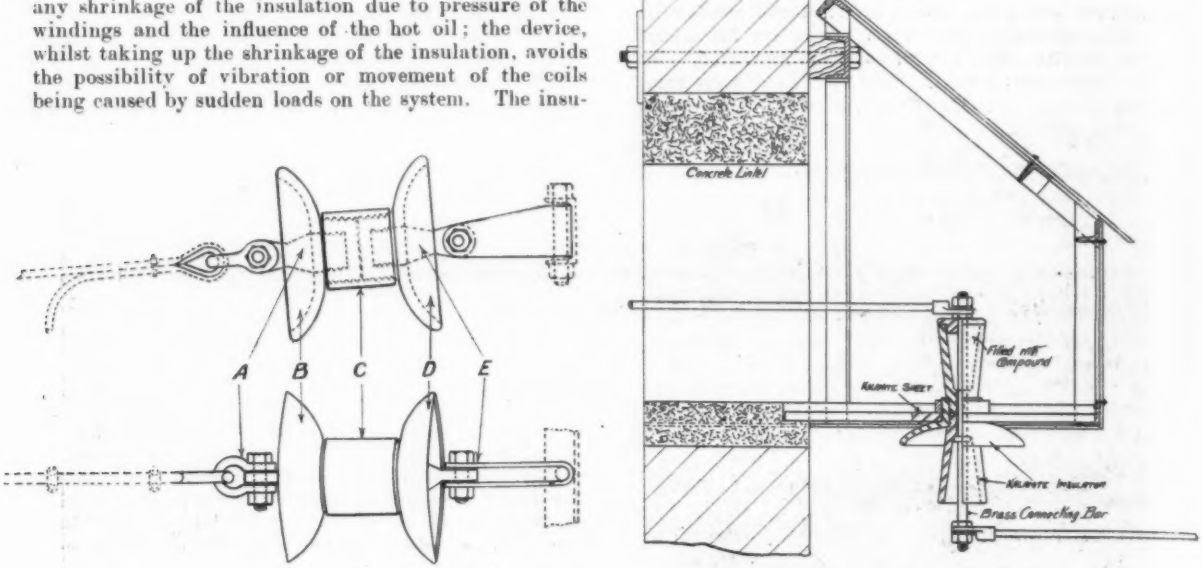


FIG. 5.—LEADING-IN 33,000-V KALANITE INSULATOR.

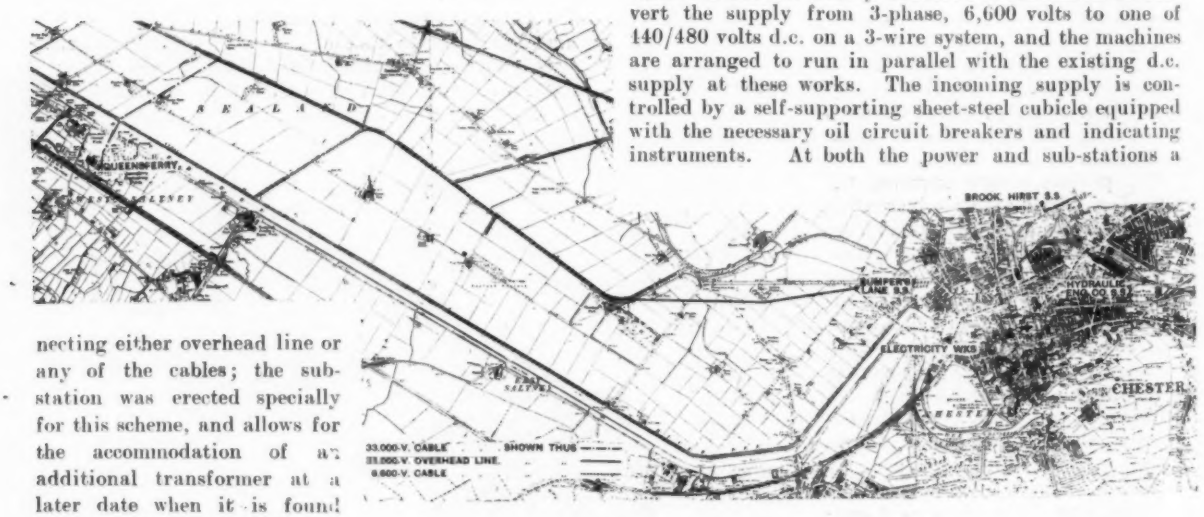


FIG. 6.—ROUTE MAP OF TRANSMISSION LINE.

The rotary converter cubicle at the power station controls a 1,000-kW, 6-phase rotary converter, also supplying a 440/480-volt, d.c., 3-wire system. This machine supplements the existing steam sets, and all the rotary converters are standard 6-phase, shunt-wound machines very similar to each other, and all arranged to start by the self-synchronising method. The voltage variation required on the d.c. side is obtained by means of field regulation; each machine is fitted with an overhung,

squirrel-cage starting motor, controlled by a special starting panel mounted between the 3/6-phase transformer and the converter. Even wear on the commutator and slip-rings is obtained by a mechanical oscillating device fitted on the end of the converter shaft, and in order to prevent the possibility of the machine racing from any cause, a speed-limiting device is provided.

The transformers for stepping-down the 3-phase, 6,600-volt supply to the 6-phase voltage necessary for converter work are specially designed for use with such machines. When the d.c. voltage variation is obtained by means of field regulation, the transformer must be provided with sufficient internal reactance to meet the

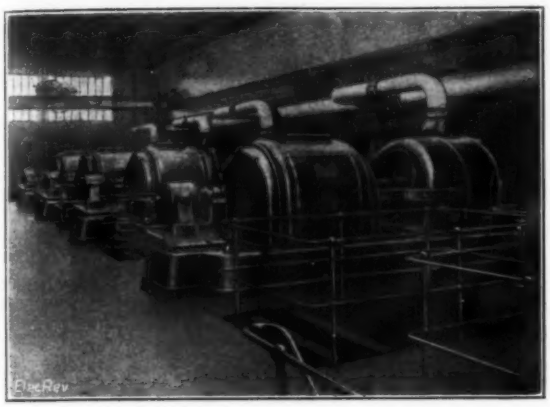


Fig. 7.—Turbo-generators at Queen's Ferry.

range of voltage required. This reactance is obtained by means of magnetic shunts placed in the transformer leakage field between the primary and secondary winding, and it is claimed that the multiple-gap construction patented by the Metropolitan-Vickers Electrical Co., Ltd., gives a straight-line characteristic, *i.e.*, the reactance voltage of the transformer increases proportionately with the load. It has given very satisfactory results in service, and does not interfere with the commutation of the converter; the method of fitting these shunts in the transformer permits of a sturdy design of transformer with improved efficiency. The transformers are oil-immersed, self-cooled, and mounted in tanks fitted with external circulating and cooling tubes. The neutral wire of the d.c. system is brought out from the mid-point of one of the l.p. transformer windings, so that the out-of-balance current is taken to a point, the voltage of which is practically fixed with reference to the positive and negative busbars. In order to maintain a good balance of pressures and correct commutating conditions, one half of the commutator-pole windings are connected in the positive lead and the other half in the negative lead. This method of balancing gives very satisfactory results, and the converter and transformer unit is capable of dealing satisfactorily with an out-of-balance current equal to approximately 25 per cent. of the full-load current.

The new station equipment for the Queen's Ferry and Chester ends, as described above, was supplied by the Metropolitan-Vickers Electrical Co., Ltd., to the requirements of Mr. S. E. Britton, the City Electrical Engineer to the Borough of Chester.

The e.h.p. cable and overhead transmission system was the work of Callender's Cable & Construction Co., Ltd., the cable portions having two working pressures. Duplicate (each 410 yd. long) 33,000-volt cables were laid underground from Queen's Ferry to the river bank, from which point the supply at the same pressure is carried by duplicate cables (each 200 yd. long) under water across the bed of the River Dee and up its opposite bank to the first terminal pole of the transmission line. This cable is 3-core, each conductor being 0.1 sq. in. in sectional area, and is paper-insulated, lead-sheathed, heavily taped and compounded, single-wire armoured, and finally heavily taped and compounded over all. The conductors are circular in shape, and the cable was manufactured to work with the centre point unearthed. Where the cable is laid in the ground, the diameter of the armouring wire is 0.128 in., but where laid on the river bed, fig. 1, the armouring wires are increased to 0.192 in. in diameter. The straight joint box used for connecting the factory lengths of cable together is designed for a 33,000-volt working pressure; and the cables are finished off inside the Queensferry works in a standard 33,000-volt dividing box, filled up with a light compound.

The overhead portion of the transmission line consists of approximately 8,000 yd. of six bare, stranded, copper conductors, each made up of seven wires 0.135 in. in diameter, having a nominal sectional area of 0.1 sq in., supported on a single line of Callender-Kay tubular steel four-legged towers (figs. 2 and 3), the average distance between poles being 475 ft., giving a clearance from the lowest conductor to the ground level in the centre of span of 20 ft. The poles are 45 ft. high, and run practically in a straight line along the top of a cop embankment. From the River Dee to the main sub-station there are 52 of these masts. A continuous earth-wire consisting of a solid copper conductor, No. 3 S.W.G., is carried below the power wires throughout the entire route. The conductors are supported on straight line poles by means of 33,000-volt pin-type porcelain insulators, and on terminal and heavy-angle poles by means of 33,000-volt Kalanite end-strain insulators; the latter were designed and manufactured by Messrs. Callender's, and are illustrated in fig. 4. This is the first occasion on which this particular type of insulator has been used on a 33,000-volt line, but it is to be widely adopted in South Wales and elsewhere—in fact, at Swansea it is to be used exclusively, and will eliminate the use of porcelain. The special features of this insulator are that it is easily assembled and installed, and that the material of which it is made possesses great mechanical strength, so that it will not chip when roughly handled; it may be used safely in tension, and its dielectric properties, it is claimed, are superior to those of porcelain. From fig. 4 it will be seen that the insulator comprises five component parts;

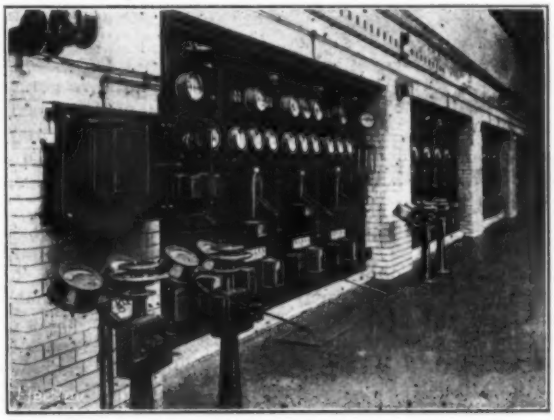


Fig. 8.—Switchboard at Queen's Ferry.

portions A C E are made of wrought iron, while B and D are made of Kalanite, and are moulded complete, including the screw threads. The method of assembling the insulator is as follows: Part A is screwed into B, C is screwed on to B, D is screwed on to C, and, lastly, E is screwed into D.

At Bumpers Lane sub-station, fig. 2, the six bare copper conductors are carried direct from the terminal pole into the building by means of a special leading-in arrangement, as indicated in fig. 5; the illustration shows that each conductor is led up through the centre of a Kalanite insulator, which is itself supported by a slab of the same material. The top portions of the insulators are filled with compound and covered by

lids, and we understand that the use of Kalanite in this instance avoided much complication in a difficult piece of work.

The map, fig. 6, shows the route of the transmission line, and it will noticed that from the Bumpers Lane sub-station to the Corporation generating station, duplicate 6,600-volt cables are laid underground, each 1,200 yd. in length. Each cable crosses the River Dee twice, the actual length of cable under water being 4 x 114 or 456 yards. One 6,600-volt cable continues onwards from the generating station for a distance of 1,700 yd. to the Hydraulic Engineering Co.'s sub-station, where it is looped in before it runs on for another 1,600 yd. to Messrs. Brook, Hirst's sub-station.

Each conductor of the 3-core, 6,600-volt cable is 0.2 sq. in. in sectional area; the conductors are paper-insulated, lead-sheathed, served, single-wire armoured, and then served overall. The conductors are delta shaped, and the cable is intended to work with the centre point unearthed. Where the cables are laid direct in the ground, they are single-wire armoured, the diameter of each wire being 0.128 in., but where they cross the River Dee an additional layer of wire armouring of the same diameter is used. The factory lengths of the 6,600-volt cables are joined in standard joint boxes.

The Queen's Ferry plant consists of four B.T.H. turbo-alternators, fig. 7, one having a capacity of 1,000 kW and three of 1,500 kW. The alternators produce three-phase alternating current at 50 periods, and at 440 volts. At present only one set is in operation, and the others will be put in commission as the load warrants. Powers are now being sought to extend the area of supply, roughly over a radius of five miles from Chester.

The Queen's Ferry plant can be operated with great economy compared with the existing Corporation plant. At Queen's Ferry a kWh of electricity can be produced for about 3 lb. of coal, whereas the plant at New Crane Street used 5½ lb. per kWh. The boilers at Queen's Ferry work at a steam pressure of 170 lb. per sq. in.; there are 32 Lancashire boilers (only three or four of which are at present in use, however). Each boiler is fitted with a Bennis sprinkler stoker and self-cleaning compressed air furnace, and is capable under normal conditions of evaporating approximately 10,000 lb. of water per hour.

The coal is handled throughout by Bennis coal and ash handling plant. The bunkers have a capacity of approximately 2,240 tons, equal to about seven days' supply for the whole of the plant.

The members of the Chester Corporation on December 9th visited the various electricity stations and sub-stations, including the hydro-electric works. Subsequently at the Town Hall the Mayor was cordially thanked for having inaugurated the supply from Queen's Ferry to Chester, and compliments were bestowed on the City Electrical Engineer, Mr. S. E. Britton, and all concerned in the acquisition of the Queen's Ferry supply.

WE SEE THEM ALL.

By W. A. C. PHILLPOT.

Our firm has always extended politeness and a few minutes to all the many travellers calling upon us—a waste of time, no doubt. The custom is, of course, a relic of those happier days when business had not departed this life, and when there was still a chance of a traveller having something of interest to offer. Nowadays the chances are a million to one against, but, conservative to the backbone, and well brought up, we keep the old custom going.

There is a strange diversity of creatures sent hourly and empty away from our office, yet they all have points in common, the chief being ignorance of the goods they are trying to sell. A law of nature, apparently, has laid it down that technical knowledge and "push" should never exist in the same man. Let's have a look at a few types.

The hearty man comes first, and oftenest. He wants to sell us a battery, and has as much chance as he would have of selling cinders in Tophet. "Ah-hah, Mr. P., and how are we this morning—pretty well? Hah—that's good." He grips me fervently and gives his imitation of Douglas Gumboil's kinema grin. "Well, I've come to sell you that little battery you inquired about the other day—Hah-hah!" Intensely jocular beast this. Mr. P., restraining his joy and keeping his face ironed flat, mentions that he has no orders to place, and never expects to want another battery in his life. "Good morning." It is as well to choke this type severely: inveterate talkers and time-wasters, they never have anything to say. His report of the call will probably read: "Very interested—send all catalogues and literature." Curiously enough, seeing how this sort abound, they must be successful travellers, the jocularly overbearing manner evidently having some fatal fascination for the average buyer.

I return to my den and dictate another letter and a half.

A pompous party, No. 2, with a special line in iron-clad switchgear. I *am* rather interested. He produces his sample switch and commences a speech on its merits. He rambles on for a minute or two before it begins to dawn on me that his speech has been composed for him by the firm's technical man. I interpose a question to make sure, and am sorry as he frowns on me majestically and goes back to the beginning. As he has no more idea of what I mean than the cat, *and* an unbounded faith in the man who wrote his speech, he does this because he knows (the man has told him so) that every query that can possibly be raised is answered in the book of words. I discover that this is a fallacy by hearing him speak his piece to the end, and then gently pushing him. His price lists and illustrations are worth a look, but his firm would have done better with a two-penny stamp. Not all men are such good listeners as I.

A third party is the young man with the aggressive mean-to-get-there manner. He gets into our office anyway. No smile here—life is real—life is earnest. He has some fuse-boxes to sell at so much to me, I suppose, less to anybody else. I mention casually that I have a similar sample, rather better quality, on my desk. "Better quality than this!" he bellows, and hits it to show his contempt for such an obvious lie. I add that my sample is also cheaper, and he wants to fight me. Having been out of training for the last thirty years, I retire and do a little more work.

The commissionaire pokes another card at me, and I again rise cursing the occasion. This party is an enthusiast, a bit loose in his statements, but with good intentions. He takes his lampholder with the air of a local mayor presenting medals, and stands it on the window ledge as if he expected me to go on my knees to it. "There, Mr. P., what do you think of that for a lampholder?"—with a tremendous beam and hand wave. I refrain from telling him that as a lampholder I think it would make a nice thimble (it would sound like sacrilege to him), and ask if there's anything special about it, and is that the best sample he's got.

He then explains the remarkable points of his lampholder, which is exactly like every other lampholder, and also that his sample is vastly inferior to the bulk of his production. Samples always are, incidentally. Price is a point to be airily dismissed by the enthusiast: "I think we're getting about 8s. 6d. for these generally,

but to *you* (how these fellows love me) I'll make it 7s. 6d." I explain as clearly as possible that (*a*) I think his holder is no good; (*b*) it is 100 per cent. too dear, and I would not buy if it were cheaper than that; (*c*) I have no orders to place. He brings out his ready reckoner to work out point (*b*), and retires with his better feelings wounded by a man of whom he expected different treatment. His looks say this.

Another type growing rapidly commoner, alas! is the man who has just learnt by heart "The Art of Salesmanship"—Chatter and Windy—9d. net. While waiting in the corridor he runs rapidly over the heads of chapter 84. "Study Your Man—Learn His Character (if any)—Find out his Likes and Dislikes—Interest Yourself in His Hobbies." When the first of these started to cross-examine me, I took him for a C.I.D. man, and, having done nothing, trembled for my liberty. The purport of his remarks broke in on me eventually, and, restraining the impulse to tell him to cut the cackle and come to business, I showed him a character from my last place, and offered as alternatives draughts and tossing the caber for hobbies, to both of which he had been devoted from childhood. He thought the latter was done with a penny, so I didn't explain that one threw bricks about on a frozen pond. [?Curling.—Eds.] It transpired that he wanted to sell me a shop sign, but as he hadn't had time to find out the price, and didn't know when he could deliver, he didn't.

The most irritating type is the long-winded person who never uses one word to explain his meaning where ten will do. Following his own mighty train of thought, he is quite unable to switch round to the buyer's point of view and offer what is wanted if it is not exactly what he has to sell. These never get orders from me if I can help it.

Not all travellers, however, are entirely obnoxious.

Two of my callers I have a special regard for, and for reasons which probably cause them to be considered unsuccessful travellers.

No. 1 is the essence of candour, and, unfortunately for himself, represents a battery manufacturer. When he first called I asked him what special reason there was for placing an order with his firm. "I get exactly the same prices from all you battery makers, and your batteries are all twins." He smiled naturally—not the usual traveller's business smirk—and said: "So they are, dammit—but I could do with a bit of commission these hard times."

No. 2, however, is my gem, and if ever I employ a traveller it shall be he, but I will send a prizefighter round with him. A quiet, unassuming little man, I doubt his ability to get past the usual mastiff commissionaire, but he knows his business from A to Z, and backwards. Although we are fairly old acquaintances by now, he never manifests that ghastly travesty of a friendly personal interest in myself that most travellers affect. A plain "Good morning," and he is down to business at once. He listens patiently and intelligently to my explanations of my requirements, has answers to all my questions on the tip of his tongue, and is always full of helpful suggestions without being too talkative (gives *me* a chance, in fact). If there is nothing for him, he wastes no time trying to force a sale—an impossible achievement at our firm—but goes, and I am grateful.

It is rather a rotten life for the traveller at present, anyhow, and the majority bear the annoyances, delays, and rebuffs common to their lot with amazing fortitude.

The ideal traveller needs the cunning of the fox, the courage and tenacity of the bulldog, the sensitiveness of the hippopotamus, and the modesty of the peacock. Rather a beastly catalogue this, but the ideal man undoubtedly cannot be the ideal traveller. I have tried travelling myself.

ELECTRICITY IN MINES.

Report of the Chief Inspector of Mines.

In the report of H.M. Chief Inspector of Mines for the year 1920 just issued it is interesting to note the gradual increase in the use of electricity in mines. This is shown in the following table:—

Table I.

Year.	Surface.		Underground.		Total.	
	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.	H.P.	Per cent. increase on preceding year.
1919	441,606	5·96	587,321	7·06	1,028,927	6·58
1920	461,954	4·61	618,868	5·37	1,080,882	5·04

The application of electricity to the various operations of colliery working is more clearly shown in Table II, which also gives details of the use of electrical plant, in each inspection division, both for coal mines and metalliferous mines.

From this table it will be noticed that the greatest application is to haulage and pumping, two of the most costly operations in mining, the next in importance being ventilation with 80,309 h.p. It may also be noticed that more than half the h.p. applied to "winding" is in South Wales, whilst on the other hand, Scotland leads in portable machinery, which includes coal cutters, having more than half the total applied to this purpose.

As regards coal-cutting machinery, there will undoubtedly be a great increase in the use of these machines within the next few years. The total number of machines in use in 1920 was 5,073, compared with 4,482 in the previous year. As the Inspector remarks, "This increase indicates that experience is disclosing the advantages of changed methods in working some seams. As time goes on, these advantages should be more and more recognised where the underground conditions are suitable for the introduction of machine coal-cutting." Tables III and IV give a complete analysis of the different types of machines in use in the various divisions and the quantity of coal won by each particular type. It will be noticed there was only *one* electrically-driven "percussive" machine at work. The production of a satisfactory machine of this type is no doubt a very difficult problem, but we sincerely hope it will some day be solved, as a satisfactory solution would supply a long-felt want. Table IV shows that the two most popular machines are the electrically-driven "disk" and "chain" types.

The most remarkable feature about these tables is the great development of electrical coal-cutting machinery in the Scottish collieries, where more than one half of the total number of machines are at work, and where more than one-third of the total machine-mined mineral was obtained.

There were unfortunately during the year 1920 nine fatal accidents due to electricity, which caused ten deaths, six of which were on the surface and three underground. In addition, electricity was a contributory cause of two accidents; one, an explosion of fire damp and air, ignited by open sparking at a direct-current motor used for driving an auxiliary ventilating fan, which caused the death of one person; the other due to the unexpected starting of a disk type coal-cutter, during replacement of the picks, which came about owing to faulty connections in the starting switch and the coincidence of a defect of insulation on the motor winding supplied from a direct-current earthed concentric

system. Of the electric shock accidents, these were in six cases due to defective insulation, one was apparently due to "practical joking," and one was due to "misunderstanding" coupled with the absence of "isolating links" or means of *locking* the switch in the *off* position. The remaining accident, which caused the death of two men, is rather unusual, it evidently being caused by "gas" originating from the oil in an oil-switch. The deceased, one an assistant electrician and the other an engine attendant, died as the result of injuries received from the flying fragments of a heavy cast-iron switch pillar in a surface engine room. This pillar exploded on being operated, the man operating the switch being killed outright; the explosion was due to the ignition of inflammable gas originating in an oil switch which was housed with other details within the pillar. Owing to defective contact, continued minute arcing probably occurred, so that the oil was "cracked" and the products spread by diffusion into the housing, which was not ventilated nor designed to resist such an explosion. The inflammable gas was ignited by the break flash of the air-break isolating switch. This isolator was interlocked with the oil switch, but served to interrupt the circuit of a potential transformer.

Only one death was apparently directly due to "defective earthing." The value of this safeguard and the importance of adequately maintaining and regularly testing the earthing circuit continue to be impressed upon all users of electrical plant; and the following suggestion by H.M. Electrical Inspector of Mines, which aims at facilitating the routine tests of earthing conductors, will be found of interest to those concerned:—

"The regulations require that earth conductors and metallic coverings shall be tested for continuity as often as may be necessary to prevent danger, and this duty is laid upon the authorised electrician.

"This requirement cannot be satisfactorily fulfilled unless suitable instruments are available, and the test of conductors, or points of contact of low resistance, cannot be made effectively with an instrument, such as an ohmmeter, designed to measure high resistance.

"A test for continuity of cable armouring should not be carried out with current from the power system owing to the danger of shock or from open sparking, and is of little value if made with a small current and sensitive galvanometer applied at one extremity of the cable system.

"To illustrate the class of test desired, the following suggestion for a simple portable outfit may be of interest:

"To avoid the difficulty and delay entailed by carrying out a test from end to end of a long cable, or of a complete cable system, at frequent intervals tests might be made from point to point on the cable armouring by means of the following outfit: A 2-volt accumulator, an ammeter, and an adjustable rheostat with two contact spikes, the whole connected in series.

"To test conductivity across a joint, the contact spikes would be applied at convenient points, and the rheostat would be adjusted to pass a standard current.

"A direct comparison could be made with an unjointed length of cable armouring or with the corresponding copper conductor.

"If desired, the rheostat could be calibrated to show

Table II.—Coal Mines.

Division.	No. of mines.	Surface. Winding.	Ventilation	Haulage.	Coal washing or screening.	Miscellaneous.	Total.	Underground. Haulage.	Pumping.	Portable machinery.	Miscellaneous	Total.	Gross total h.p.
1. Scotland	352	4,212	7,137	4,331	10,019	17,351	43,050	47,738	77,599	34,067	6,788	166,192	209,242
2. Northern	268	18,282	24,917	15,356	18,371	47,991	124,917	57,270	59,830	6,662	5,052	128,814	253,731
3. York and North Midland	246	1,990	16,238	4,896	27,374	59,080	109,578	48,716	29,195	12,350	3,764	94,025	203,603
4. Lancashire, N. Wales, and Ireland	139	335	5,028	1,669	4,969	12,985	24,986	14,935	17,082	1,819	455	34,291	59,277
5. South Wales...	341	27,661	23,660	18,543	12,042	52,785	134,691	62,813	70,445	2,449	1,917	137,624	272,315
6. Midland and Southern	158	485	3,329	2,616	5,008	13,294	24,732	25,577	25,461	4,867	2,017	57,922	82,654
Total h.p.	1,504	52,965	80,309	47,411	77,783	203,486	461,954	257,049	279,612	62,214	19,993	618,868	1,080,882
Metalliferous Mines.													
1. Scotland	9	67	—	114	—	457	638	115	315	40	103	573	1,211
2. Northern	20	40	—	16	—	698	754	466	3,449	5	476	4,396	5,150
3. York and North Midland	9	27	2	51	—	302	382	7	211	20	—	238	620
4. Lancashire, N. Wales, and Ireland	13	1,101	—	201	—	1,319	2,621	1,004	1,067	9	356	2,436	5,057
5. South Wales...	3	119	—	—	—	433	552	—	76	—	—	76	628
6. Midland and Southern	14	375	256	164	—	4,432	5,227	10	2,095	24	23	2,152	7,379
Total h.p.	68	1,729	258	546	—	7,641	10,174	1,602	7,213	98	958	9,871	20,045

Table III.

Number of Coal Cutters of Each Type in Use, Mineral Obtained, and Number of Conveyors at Coal Face in Each Division During the Year 1920.

Division.	No. of mines at work in division	No. of mines using machines.	Percentage using machines.	Type of machine. Disk. Electricity	Disk. Compressed air	Bar. Electricity	Bar. Compressed air	Chain. Electricity	Chain. Compressed air	Percussive. Electricity	Percussive. Compressed air	Rotary heading. Electricity	Rotary heading. Compressed air	Totals. Electricity	Totals. Compressed air	Mineral obtained.	No. of conveyors at coal face.
																Tons.	
Scotland	518	252	48·6	631	93	366	3	151	5	—	30	1	—	1,149	131	10,859,652	109
Northern	469	126	26·9	51	47	29	23	135	44	—	924	—	4	215	1,042	5,195,720	99
York and N. Midland	475	137	28·8	156	119	78	31	232	168	—	193	8	3	474	514	7,815,613	191
Lancs, and N. Wales	309	103	33·3	8	109	33	61	28	82	—	546	—	10	69	808	2,938,714	53
South Wales... ...	614	65	10·6	2	2	26	14	44	101	—	50	—	—	72	167	1,076,730	339
Midland & Southern	466	77	16·5	23	13	18	12	132	92	1	138	1	2	175	257	2,859,845	32
Total in 1920 ...	2,851	760	26·7	871	383	550	144	722	492	1	1,881	10	19	2,154	2,919	30,746,274	823
				1,254		694		1,214		1,882		29		5,073			
Percentage of total...	—	—	—	24·7		13·7		23·9		37·1		0·6		42·5	57·5		
Total in preceding year	2,843	729	25·6	876	388	489	128	573	400	7	1,598	5	18	1,950	2,532	28,081,017	712
				1,264		617		973		1,605		23		4,482			
Percentage of total...	—	—	—	28·2		13·8		21·7		35·8		0·5		43·5	56·5		

the approximate ohmic value of the resistance under test.

"Such a test could be carried out without danger or interruption of service and, by suitable organisation, the whole cable system could be surveyed at reasonable intervals of time."

The reports on electrical accidents in mines should be carefully studied by all engaged in operating and supervising electrical plant, as in most cases the accidents are due to neglect on the part of someone, and all cables and connections should be either in such a position or so protected that it is impossible for foolish and ignorant boys or workmen to interfere in any way with them, and still less to be able to connect or manipulate live wires or make connections for the purpose of "practical joking." It seems strange to electrical engineers, who are aware of the dangers of electric shock, that anyone should be so foolish as to attempt practical joking with electric current from main cables, whether for lighting or power purposes; yet the sad fact remains that several deaths have occurred at mines through this cause. Those engaged in designing electrical switchgear and plant for use in mines should pay particular attention to making as far as possible everything absolutely foolproof, and in portable machinery, where flexible connections are to be made, to see that these are of sound mechanical construction. Nothing shoddy or cheap is fit for the rough usage encountered in a coal mine.

The use of electric safety lamps is rapidly making headway, there being 245,900 in use in 1920, as compared with 197,722 in the previous year. The better light and the great security these lamps give are certainly worth the little extra cost.

TABLE IV.

QUANTITY OF MINERAL GOT BY EACH TYPE OF COAL CUTTER IN EACH DIVISION DURING THE YEAR 1920.

Division.	Description of mineral.	Type of machine and motive power.										Totals.		Grand totals.
		Disk.		Bar.		Chain.		Percussive.		Rotary heading.				
		Electricity.	Compressed air.	Electricity.	Compressed air.	Electricity.	Compressed air.	Electricity.	Compressed air.	Electricity.	Compressed air.	Electricity.	Compressed air.	
		Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Scotland	Coal	6,949,247	670,261	2,581,908	14,450	1,158,325	41,314	—	41,584	341	—	9,939,811	770,649	10,859,652
	Ironstone	63,572	15,208	37,321	1,056	—	—	—	—	—	—	100,693	16,264	
	Fireclay,	10,846	—	21,389	—	—	—	—	—	—	—	32,235	—	
Northern	Coal	445,846	348,125	161,025	175,476	1,207,517	326,690	—	2,511,876	—	400	1,813,883	3,372,567	5,195,720
	Fireclay	—	—	—	—	—	—	—	14	—	—	—	14	
	Ironstone	—	—	—	—	—	—	—	9,251	—	—	—	9,251	
York and North Midland..	Coal	1,209,009	1,064,047	735,869	441,557	2,043,803	1,995,870	—	288,109	3,616	11,832	3,992,297	3,801,412	7,815,613
	Fireclay	—	107	—	—	3,933	—	—	13,469	—	—	3,935	13,776	
	Ganister	—	—	—	—	—	—	—	4,193	—	—	—	4,193	
Lancs. and North Wales..	Coal	59,483	613,017	213,976	419,747	150,915	599,051	—	878,234	—	4,300	424,365	2,514,349	2,938,714
South Wales	Coal	20,500	8,416	160,190	46,750	223,368	611,456	—	65,830	—	—	344,067	732,463	1,076,730
	Fireclay	—	—	—	—	—	—	—	200	—	—	—	200	
Midland and Southern ..	Coal	268,947	185,668	106,584	75,071	965,568	749,407	375	186,332	—	486	1,341,474	1,146,964	2,859,845
	Ironstone	—	—	36,892	—	293,597	6,790	—	22,819	11,806	—	341,795	29,612	
Total ..	Coal	8,252,529	2,889,534	3,849,552	1,178,051	5,749,496	4,336,883	375	3,971,968	3,947	17,018	17,855,902	12,388,404	30,194,306
	Ironstone	64,872	15,208	74,213	1,056	294,597	6,790	—	32,070	11,806	—	442,488	55,127	497,615
	Fireclay	10,846	107	21,389	—	3,935	—	—	13,883	—	—	36,170	13,990	50,160
	Ganister	—	—	—	—	—	—	—	4,193	—	—	—	4,193	4,193
Grand total in 1920.. ..	All miner'ls	8,328,747	2,854,849	3,945,157	1,174,107	6,047,028	4,343,626	375	4,022,114	15,253	17,018	18,334,560	12,411,714	30,746,274
		11,181,596		5,119,264		10,390,654		4,022,489		32,271		30,746,274		
Percentage of total.. ..	—	36·4		16·6		33·8		13·1		0·1		59·6	40·4	100·0
Total in preceding year ..	All miner'ls	8,695,007	3,090,481	3,528,657	1,101,712	4,582,307	3,435,271	1,886	3,621,089	2,474	22,133	16,810,331	11,270,686	28,081,017
		11,785,488		4,630,369		8,017,578		3,622,975		24,607		28,081,017		
Percentage of total.. ..	—	42·0		16·5		28·5		12·9		0·1		59·9	40·1	100·0

The use of electric safety lamps is rapidly making headway, there being 245,900 in use in 1920, as compared with 197,722 in the previous year. The better light and the great security these lamps give are certainly worth the little extra cost.

ELECTRICALLY-DRIVEN FIRE-FIGHTING APPARATUS.

By E. KILBURN SCOTT.

THE New York fire-fighting department has not yet adopted electrically-driven engines, but some of the neighbouring towns have done so on a considerable scale. For example, Paterson, in New Jersey, has a completely "motorised" fire department. This city is a silk manufacturing centre, and has a large foreign population, many hilly streets, and a residential district where most of the houses are of frame construction.

The Fire Department consists of fifteen companies, and the electrically-propelled apparatus includes nine engines, ten combination wagons, and three ladder trucks. Most of them have been converted by removing the gasoline engines and installing the electric drive. They were originally built to be drawn by horses; later gasoline tractors replaced the horses, and finally electric motors and storage batteries have replaced the engines.

To electrify the pumping apparatus, all the running gear forward of the gooseneck was removed, and channel beams, long enough and heavy enough to carry the storage batteries, the chauffeur's seat, and the driving and steering apparatus, were riveted on. The rear wheels, the boiler, and the pumps were not touched.

For the ladder trucks, the frame was extended to provide space for the driving mechanism, and the battery box was suspended under the frame and just forward of the rear wheels. An entirely new set of wheels was mounted, each wheel having its individual electric motor. Lengthening and strengthening the frames and the installation of motors for each of the rear wheels accomplished the same results for the combination wagons.

During 1919 the department responded to 511 alarms, and reached the fires so promptly that in only four cases did the blaze extend beyond the original building. The damage in the most disastrous fire of the year amounted to only 209,000 dols., and the average loss in the next four fires was less than 50,000 dols., while the average loss in all fires, including the big ones, was less than 900 dols.

In a recent test on Temple Street, having a gradient of fourteen per cent. and three blocks long, the truck

climbed the distance in one minute and fifteen seconds. Another incline of seventeen per cent. was negotiated in sixty-two seconds, and not only did the "electric" climb from a standing start, but it stopped in the middle of the hill and started again without any assistance. A speed of thirty-four miles per hour is maintained on the level.

The fire chief says that "the electric trucks are the most reliable, least expensive, and best type of vehicle for fire department usage." The labour of the department has decreased nearly seventy per cent. since the introduction of electric trucks three years ago, and with the exception of a smash into a tree, not one of the electric trucks has ever been out of service for as long as twenty-four hours.

About a dozen other cities in the Eastern States have adopted electrically-propelled fire-fighting apparatus.

CORRESPONDENCE.

Letters received by us after 5 p.m. on TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Fire at Carmarthen Electricity Works.

I shall be pleased if you will permit me, through the medium of your paper, to express my gratitude to the many sympathisers and for the offers of help I have received from both individuals and manufacturers, to which it is impossible for me to reply individually.

I must say it has surprised me, and I feel all the more grateful. The prompt action of Messrs. Mirrlees, Bickerton and Day, Ltd., our engine builders, and the Western Engineering Co., Swansea, who carried out the temporary electrical repairs, with the permanent staff under me, who worked as only Britons can do day and night, achieved a task I can only describe as wonderful, in renewing the supply after eight nights of darkness.

The seriousness of the fire, owing to the highly inflammable crude oil and the wood and slate roof, can hardly be described. Its effect has taught me a lesson, as well as those similarly situated as we were with this type of plant, and I shall be pleased to impart information to any engineer who will write me, to safeguard himself from any such like occurrence.

I must also say that my company is most grateful to the Corporation of Carmarthen, a deputation of which, including the Mayor, waited on the directors to express their sympathy and offer of help; also to the townspeople, who realised the serious situation and most patiently waited for the resumption of supply.

A. Preston, A.M.I.E.E.,
Manager and Engineer.

Electricity Works, Carmarthen.
December 16th, 1921.

The Durability of Lead-covered Cable.

The question of lead-covered wiring is of interest to us here, as we have been using the system in Salisbury since 1898, and I think well over 100 miles of this wire is in use on our consumers' premises.

We use lead-covered twin paper-insulated wire; the joints are covered with sheet lead, which is folded round them, and sweated on to the lead of the wire by means of a small blowpipe. The wire is sealed into varnished hard-wood blocks with insulating wax at the ceiling roses and switches; lead blocks can be used in damp places if desired. No looping is done.

The whole system is watertight and absolutely satisfactory. A number of installations have been in use for over 20 years, and are quite in order at the present time; none have had to be pulled out except where the fault has been quite definitely traceable to bad workmanship.

The essentials for making a success of the system are:—

1. Good workmanship, with a knowledge of the system.
2. Proper earthing of the lead covering.
3. The wire not to be covered with plaster or cement without proper protection.
4. The system not to be used in a place infested with rats or mice, as they eat the lead.

I have no doubt that these necessary conditions have not been complied with in the cases of trouble quoted by other correspondents. Good workmanship and a thorough knowledge of the system are absolutely essential, as it is obvious that if paper-insulated wire is not properly sealed up, there will soon be trouble if the slightest damp gets to it.

A. B. Randall,

Electricity Works, Salisbury,
December 17th, 1921.

One Solution of the Frequency Problem.

Replying to both Mr. A. L. Firth's letter of the 6th inst., and Mr. Sutton's letter of the 6th, the difficulties which are referred to in dealing with odd frequencies could be overcome with two alternators coupled in tandem in the manner I suggested, by utilising low-speed type alternators gear-driven from the turbine. Although I have no actual figures before me, I believe I am correct in saying that the combination of a low-speed type alternator with gear and a higher-speed turbine is as cheap as, say, a standard 3,000-r.p.m. turbine with direct-coupled alternator, and there is little difference in the overall efficiency. With low-speed type alternators the objections raised could be overcome.

It would be interesting to know how a set of this description would compare with the scheme outlined by Mr. Sutton, and as will be seen, the employment of low-speed alternators would enable a direct-current generator to be coupled up if required. The all-important fact remains that the losses with a coupler set must be very considerable, and if these are capitalised they should leave a very large margin in favour of a tandem scheme such as I suggest.

With regard to the question of power factor, I have always maintained that it is wrong to correct the power factor at the power station, but right to aim at raising the power factor at the point of consumption.

E. W. Dorey.

London,
December 17th, 1921.

Tracing Mains.

In the article on "Mains Photography," by Mr. A. F. Beach in your issue of December 2nd, 1921, the need for the use of photography appears to have risen out of a difficulty in finding the exact position of a power main under a field, owing to the cable having been laid in a position not in accordance with the plans. It is suggested that the position of the cable could have been found quite easily with the aid of a search coil, as there are very few underground power mains which cannot be detected by this simple piece of apparatus.

As I have frequently met power engineers who are ignorant of this method of detection, the following description of an efficient search coil may be found of value: Some 40 turns of covered wire, No. 22 S.W.G., should be wound on a rectangular light wooden frame with sides about 3 ft. by 1 ft. 6 in., and the wires should be connected to a 60-ohm telephone receiver. The best type of coil is one in which the impedance of the coil equals the impedance of the telephone receiver. The one described will be found convenient to handle, and, if a good telephone receiver is employed, very effective in use. A hum is heard when the coil is parallel with the main, with varying degrees of strength to silence between that position and when the coil is at right angles.

S. C. Bartholomew.

London,
December 15th, 1921.

Leaves from an Inspector's Note Book.

To insurance inspecting engineers, both "Anode's" articles and Mr. A. J. Abraham's letters are nauseous. "Anode's" fairy tales about changing-over starter connections and reversing 3-phase motors make engineer surveyors look the fools that Mr. Abraham thinks they are.

"Anode" states that after his experience at the pork butcher's he never made an inspection without seeing the machine run, yet later he admits passing for insurance a motor which he never even saw at work, which, to my mind, is more important that the checking of dimensions and a megger test.

The *nom-de-plume* of the author prevents us of the inspecting fraternity from pulling his leg, as he appears to glory in doing to his company's clients and their engineers.

Now I wonder how much our friend Mr. Abraham knows about insurance companies' business or their inspectors' duties and salaries. It was he who, in a previous letter, compared insurance companies to Hebrew money lenders. It is quite obvious that any plant insured by his department is insured without his permission, and that probably at some time he has had his "throne" shaken by an inspector's report (in spite of the inspector only getting a third of his salary), hence the bee in his bonnet still continues to buzz. As to an inspector to-day earning less than a fitter, I challenge him to prove that he has an ordinary fitter in his employ earning even as much as a newly-appointed inspector for a normal working week, thanks to the efforts of the Engineer Surveyors' Association. It is very probable that comment has been made about his balancer fuses being too heavy, but I again challenge him to produce an insurance company's report suggesting fitting fuses in the shunt leads of a dynamo. As to his test of a motor reported to be hot, I would ask if he never heard of a motor being badly overloaded? The firm would not do this, naturally, when they knew his test was on; and as to the inspector's instruments for checking the temperature, a thermometer is part of his equipment for motor inspection, hence

his report is just as likely to be correct as that of a certain individual, who apparently rides the high horse pretty handsomely as far as Aberdare is concerned.

N. W. Walker, A.M.I.E.E.,
Engineer-Surveyor.

Sheffield.
December 17th, 1921.

Neon Night Lamps.

I should be obliged if you could offer any explanation of the following regarding a Neon lamp: (1) When switched on after a long period of rest the lamp refuses to light up. If the lamp is then momentarily connected to the secondary of a spark coil (giving about 3-16 in. spark) and then replaced on the lighting circuit the lamp lights up promptly. Circuit is 205 volts, 50 periods. (2) In the case of one lamp it became necessary to re-fix the brass cap, and on removing the globe from the cap previously to re-cementing, I find that there is a bobbin wound with very fine, enamel-insulated wire concealed within the cap of the lamp. Can you favour me with the object of this?

Charles W. Cook.

London, *December 17th*, 1921.

[The Neon lamp partakes of the nature of an arc lamp; there is no metallic connection between the electrodes. Hence the gas must be ionised before the arc can be struck, and this is effected by the process mentioned by our correspondent—but the case appears to be exceptional, as the lamps normally light up without difficulty.

Presumably the fine wire is a ballast resistance, necessary to give stability to the "arc," which would have a so-called negative resistance.—Eds. Elec. Rev.]

[Our correspondent who signs himself "Ginger Beer" is informed that his letter cannot be published unless his name is in our possession. A letter sent to his address has been returned by the Post Office.—Eds. Elec. Rev.]

REVIEWS.

Thermionic Tubes in Radio Telegraphy and Telephony. By John Scott-Taggart. Pp. xxiii+424; figs. 344. London: Wireless Press, Ltd. Price 25s.

Since the war a considerable number of books has appeared on the subject of the thermionic valve and its various applications to wireless telegraphy and telephony. Nearly all these books have discussed the subject with the aid of more or less advanced mathematics, but although such a method of treatment is very necessary if exact ideas are to be obtained, yet it must be confessed that even the reader who is competent to cope easily with the mathematics does not always obtain in this way as clear a mental picture as is desirable of the phenomena involved, apart from the symbols in which they can be expressed, while for the reader whose mathematical attainments do not reach the necessary level, such books are almost useless. Now it will be readily admitted by anyone, who has had practical experience with wireless gear, that it is the possession of such clear conceptions of what is actually happening which is the really important mental equipment needed for such work. If this equipment can be obtained by the way of exact mathematical reasoning, so much the better. But a sufficiently good conception for practical purposes of what is occurring in the gear, and of the results produced by changes in the various adjustments, can be obtained without mathematical aid, if the explanation be given in a clear and logical manner. The author of the book under review has succeeded in doing this extremely well; in fact, we have no hesitation in saying that, for the average wireless operator, or for the amateur who wishes to be able to use his set in an intelligent manner, it is the best elementary book on the subject which has so far appeared.

The book is divided into fifteen chapters. In the first two, the general theory of thermionic currents and their practical application in two and three electrode valves are described. The next two chapters deal respectively with the valve as a detector and as an amplifier. The application of the principle of retro-action is next dealt with. Then follow chapters on multi-stage high and low frequency amplifiers, on combined high and low frequency amplifiers and on circuits using multi-stage amplification with retro-action.

The next two chapters describe the use of the thermionic valve for the reception and the generation of continuous waves. The following two deal respectively with various applications of the valve to the measurement of wave-length, capacity, &c., and the use of the valve in wireless telephony.

In the remaining two chapters the Dynatron, the Turner relay, and several other miscellaneous valve devices are described.

The book is well printed on good paper, and the numerous diagrams are clearly drawn and well reproduced. There is a refreshing absence of padding with photographs of apparatus which, however much they may appear to lighten a book, seldom convey any information of value to the reader.

We have only noticed two printer's errors. On page 55, line 33, a bracket has been misplaced. Incidentally, we think that the argument would be clearer if the last two expressions in this line were reversed, so that the line read:

$$I_1X = 2AX = (I_1B + BX).$$

On page 157 reference is made to a "coil R" in fig. 118. No coil lettered thus is shown in the diagram, and the "R" appears to be a printer's error for "AB."

We have only a few adverse criticisms to offer. On page 10 the author defines an electrostatic line of force as the line along which "a unit positive charge of electricity (*according to the old idea*), would travel." (The italics are ours.) Although modern ideas about electricity are somewhat different from the old ones, yet we think that positive charges of electricity still tend to move along the lines of an electrostatic field, in just the same way as they did in the old days.

On page 43 and again on page 84, the statement is made that the e.m.f. of a battery having appreciable internal resistance drops immediately an external circuit is connected across the battery terminals. Instead of the e.m.f., of course, the external voltage of the battery is meant, the e.m.f. remaining unchanged as long as polarisation effects do not occur.

On page 121 the symbol κ is used for the capacity of a condenser in farads, instead of the international symbol C. This is the more desirable as on other occasions, as, for example, on page 209, the symbol C is employed.

On page 394 reference is made to attempts "to obtain simultaneous transmission and reception in wireless telephony, *so as to reproduce the conditions existing on an ordinary telephone circuit.*" (Our italics.) We think that if the author notices carefully what happens the next time he uses a telephone, he will realise that with an ordinary telephone circuit simultaneous transmission and reception, that is, duplex working, is not possible, even if two persons, one to speak and one to listen, be installed at each end of the line. With an ordinary telephone the listener can, if necessary, interrupt the speaker, and this is what is desired with wireless telephony, but such an arrangement is not *duplex* working.

With the exception of the foregoing small points, however, we have found nothing amiss with the book, which, we are sure, will meet with a warm welcome from elementary students of wireless telegraphy.

Relativity and the Electron Theory. By E. Cunningham, M.A. Pp. ix+146; figs. 9. London: Longmans, Green and Co. Price 10s. 6d. net.

The author will probably be known to many of our readers as the writer of a very concise account of the principle of relativity published in 1914. He furnished one of the readiest means available of becoming acquainted with this difficult subject at the time, and there must have been few who consulted the book who had not reason for being grateful to its author. The present volume is the second edition of a work designed to extend the usefulness of the first by expanding it to embrace the ever-growing complexities of the subject. An attempt has been made to set out the relation of the electron theory and the theory of gravitation to the principle of relativity, and mathematical analysis has been omitted to a large degree with the idea of making the book of greater interest to the general reader. The theory of relativity is, however, essentially mathematical. Take away the mathematics and there is really nothing left. So members of the general public who come to this book or any other that deals with the same subject, without bringing some knowledge of mathematics, are bound to be disappointed. In this edition, besides the special theory of relativity as first worked out, the general theory of relativity as developed by Einstein is explained, and the reasoning which led to its conception is clearly described.

This aspect of the theory is probably the one which will appeal most to those readers who are repelled by mathematical symbols. An exact physical law is a statement of equality which remains true, whatever means of expressing it may be adopted. Newton's laws hold good for some frames of reference, but not for others. It is repugnant to the scientific mind that physical truth should depend on the frame of reference chosen to express it. This was the essence of the problem Einstein set himself to solve, and he reached his solution by the aid of systems of pure mathematics devised by other persons having other aims in view. So true it is that he who helps himself helps another. The last chapter deals with Weyl's theory of electricity. Weyl has done for electricity what Einstein did for gravitation, namely, shown that a measure-system can be found in which the mathematical relations of nature can be expressed in the simplest possible form, in terms of poly-dimensioned space and time. But so far no experimental test has been devised by which the accuracy of Weyl's hypothesis can be verified. Those who desire to follow this line of thought more closely will prefer Mr. Cunningham's larger book on the subject, but it may be safely conjectured that the curiosity of most people will be sufficiently satisfied by the perusal of the 146 pages contained in this.

BUSINESS NOTES.

Bankruptcy Proceedings.—Thomas Rawsthorne, 67b, Paradise Street, West Bromwich, electrical engineer.—The public examination of this debtor was held on December 14th at West Bromwich. The liabilities were returned at £244, and there was a deficiency of £203. Debtor attributed his failure to the fact that many works had had to close down, and the trouble had been made worse by strikes. He became aware of his position in June last.

Joseph Owen (trading as J. Owen & Sons), 186, Westcombe Hill, and 3, The Grove, Greenwich, Kent, electrical engineer.—The following are creditors:—

	£		£
Budd & Son, H. W.	18	Lindsay, —.	250
Craggs, C.	12	Marchant & Miller	14
Crow, Toogood & Co.	30	National Electric Co.	22
Edey & Co.	16	Rose Bros.	42
Edison Swan Electric Co. ...	12	S. Met. Electric Light Co. ...	30
Electrical Supplies Co.	123	S.E. & Chatham Railway ...	12
Falk, Stadelmann & Co.	40	Sunlight Manufacturing Co. ...	38
General Electric Co.	106	Watchams, —.	30
Hipkin, —.	230	Watts, —.	100
Albert Lee & Co.	118		

J. H. Hopkins (Electrical Maintenance Co.), 57, Castellaine Mansions, Maida Vale, and lately carrying on business at 140, Wardour Street W.—Receiving order made November 30th on creditor's petition. First meeting, December 30th. Public examination, March 3rd, both at Carey Street, W.C.

A. V. Fowler (A. Vaughan Fowler), electrical engineer, Seacliffe, Fitzroy Avenue, Kingsgate, Kent.—First meeting, December 23rd, at the Official Receiver's Office, 68a, Castle Street, Canterbury. Public examination, January 7th, at the Guildhall, Canterbury.

J. H. Toms, electrical engineer, 13, Gray's Inn Road, W.C.—Last day for proofs for dividend, December 31st. Trustee: Mr. H. J. de Courcey Moore, 2, Gresham Buildings, E.C.

S. H. Dougherty (Mersey Electric Co.), electrical engineer, Liverpool.—First and final dividend of 9d. in the £, payable at 30, North John Street, Liverpool.

Dissolutions of Partnership.—Feneley & Co., mechanical and electrical engineers, 40a, Windsor Bridge, Salford, and Hawthorn Road, Hale.—Mr. G. H. Feneley and Mr. H. T. Blood have dissolved partnership, and both will attend to debts, &c.

Manchester Electric Repairing & Maintenance Co., electric light and power engineers, 53, Regent Road, Morecambe.—Messrs. C. H. S. Naylor and J. E. Bradley have dissolved partnership. Mr. Bradley will attend to debts.

Trade Announcements.—Messrs. Higgs Bros., of Sand Pits, Birmingham, inform us the telephone number of their Manchester branch (3, York Street) is City 3713.

Messrs. Engineering Supplies, Ltd., have transferred their electrical branch to larger premises at 155a, Upper Thames Street, E.C.4, where they hold stocks of silk-covered wires, cables, and flexible cords.

Messrs. Berry's Electric, Ltd., have recently established a branch at 16, Donegall Square South, Belfast, for the control of their Irish business in switchgear, "Magicoal" electric fires, &c.

The Hotpoint Electric Appliance Co., Ltd., has removed to 21, Berners Street, Oxford Street, London, W.1, where, in extensive showrooms, it will exhibit a complete range of Hotpoint electric appliances. A special model kitchen and dining room have been installed.

Mr. J. Cooper, of 10, Church Street, Haslingden, has taken over the Haslingden branch of the East Lancashire Electrical Co., and will carry on the business in his own name at the above address.

Mr. W. Crabtree, electrical engineer, Barnsley, has opened new premises at 28, Peel Street.

Catalogues.—The Ajax Electrical Co., 291-3, High Road, Ilford.—An illustrated price list of domestic electrical appliances—fires, kettles, irons, cookers, &c.

Messrs. J. Berg & Co., 169, City Road, E.C.1.—An illustrated sheet giving prices of bell pushes and burglar alarms.

Messrs. Simpson, Baker & Co., 4, St. Augustine's Place, Tramway Centre, Bristol.—A net price list of electrical accessories and materials, including switches, wires and cables, insulating material, &c.

Messrs. Ashworth & Smith, 50, Whitworth Street, Manchester.—Bulletin No. 628, illustrating and describing the "Homecharger," a small transformer and rectifier for charging small batteries from a.c. circuits.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publication No. 303, giving illustrated details of automatic interphone systems. Priced.

Dictograph Telephones, Ltd., Aurelia Road, Mitcham Road, Croydon.—"The Buzzer"—the firm's house organ, containing interesting and amusing notes, and a number of appreciative letters from "Dictograph" users.

Messrs. C. A. Vandervell & Co., Ltd., Acton, W.3.—Folder "M" giving numerous illustrations of electric lighting components for motor-cycles and side-cars. Fully priced.

Automatic and Electric Furnaces, Ltd., 281-283, Gray's Inn Road, W.C.1.—A pamphlet explaining "Why Germany Buys British Furnaces" and illustrating a typical "Wild Barfield" electric furnace.

The Cambridge & Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A card giving an illustration of a "Cambridge" draught gauge and prices of draught and pressure gauges.

British Insulated & Helsby Cables, Ltd., Prescot, Lancs.—Publication No. P.171, giving details and illustrations of aluminium matting, and aluminium of various sections.

Economic Electric, Ltd., 10, Fitzroy Square, W.1.—A well-illustrated catalogue giving prices and descriptions of all kinds of wireless apparatus.

Messrs. Sutcliffe Bros., 90 & 91, Queen Street, Cheapside, E.C.4.—List No. 1221C, giving sizes and prices of cables, conduits, bell wires, &c.

Messrs. R. A. Evans, Ltd., Prospect Road, Leicester.—A series of illustrated leaflets (bound), giving particulars and prices of lift accessories, including terminal boxes, limit switches, interlocks, &c.

Messrs. Newton & Wright, Ltd., 471-473, Hornsey Road, N.19.—An illustrated detailed description of the "Snook" X-ray apparatus for the purpose of rapid radiography.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—"Transformer Abstracts," No. 2. "Inquiries and Tenders." This is the second of a series of booklets designed to aid both salesmen and buyers in the proper understanding of transformers and their working.

Catalogues Wanted.—Messrs. Fitzgerald Bros., electrical engineers and contractors, of 18, East Beach, Cove, co. Cork, desire to receive catalogues of electrical goods.

H.M. Trade Commissioner's Office at Trinidad reports that a British West Indian firm wishes to receive catalogues and current price lists from British manufacturers of electric motors. The name and address is obtainable at the Department of Overseas Trade in London.

Calendars and Almanacs.—The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, E.15, has sent us one of its desk blotting pads as in previous years. On each of the blotting sheets a calendar for 1922 is printed in small type.

From Messrs. Fredk. Hodgson & Co., Ltd., of 24, Queen Victoria Street, London, E.C.4, we have received a wall calendar with small monthly slips for 1922 printed beneath a reproduction in colour of H.M.S. *Renown* "in the teeth of a gale" (Montague Dawson).

The Westinghouse Electric International Co. has prepared a pocket diary for 1922 containing particulars of the company's industries and a series of maps of different world markets.

Messrs. John Armstrong & Co., Lancaster Buildings, Barton Square, St. Ann's Street, Manchester, have issued a wall calendar with a daily date pad for 1922.

A striking souvenir has reached us from Mr. George Ellison, of Birmingham. A good deal might be written about it after contemplative and imaginative study. Men engaged in industry can learn important lessons from it if they will. We are all learning nowadays, perhaps by bitter experience, that it is sometimes necessary to compel ourselves to leave our work entirely alone, so as to recover from the effects of wear and tear. Life may become too monotonous and fatiguing if we are not careful. The dull, smoky life of the factory is used as a background in this picture, and upon it there is laid in colour the human interest side of life in the form of a beautiful girl. It is a study in contrasts—the unattractiveness of incessant work placed against one who may represent the softening and sweetening influences of life. Of course, other constructions are possible, and we may be wrong in our conception of the meaning of the design, but we like this version best because we think it the loftiest.

Messrs. Simplex Conduits, Ltd., have sent us the 1922 edition of their handy pocket book and diary, with revised technical tables and data of use to the electrical engineer—a very well-planned book, and a friend of long standing.

From the Keighley Gas & Oil Engine Co., Ltd., of Imperial Works, Keighley, we have received a calendar with a block of daily date slips for 1922 on a cardboard base cut to Imperial engine shape.

The Dearborn Chemical Co., of Chicago, has issued a wall calendar for 1922 in the form of large monthly sheets.

The Park Royal Engineering Works, Ltd., of Cumberland Avenue, Park Royal, London, N.W.10.—A pocket diary and memorandum book with calendars, useful tables, and insurance policy. A most acceptable souvenir.

The Key Engineering Co., Ltd., of Trafford Park, has issued its usual celluloid pocket slip with calendar for the new year.

West of England District Board.—A satisfactory report was presented at the annual meeting of the District Joint Board for the West of England Area (Employers and Staff Members, Electricity Supply Industry). Ald. A. A. Senington (employers) was elected chairman for the ensuing year, and Mr. A. J. Ostler (staff members) vice-chairman.

Holidays.—*The Times* says that shipyards and engineering establishments on the Clyde will close down for ten days at the year end.

The works of MESSRS. BRUCE PEEBLES & CO., LTD., will be closed from Friday, December 30th, until Monday, January 9th.

The Electrical Industry in Saxony.—According to an article in the *Leipziger Tageblatt* of December 2nd, the receipt of orders in Saxony is at the present time brisk. As a result of the fall in the mark, prices have been materially increased (approximately 50 per cent.) since October 1st. This is due to the fact that the electrical engineering industry is dependent on foreign countries for about 60 per cent. of its supply of raw material, particularly copper, india-rubber, and cotton. The price increase which has taken place since the last fall of the mark does not at present correspond to the fall in value of the mark. There has been a passing decrease in the number of orders received since the latest increase in prices, but there are at the present time so many projects in course of completion that it is expected that a still more considerable number of orders will be received unless prices again rise materially. The article, a copy of which was forwarded to the Department of Overseas Trade by the Acting British Consul in Leipzig, says:—" With regard to orders received, our great electrical enterprises have made one remarkable observation. Previous to the war, approximately 40 per cent. of our total production was exported. This 40 per cent. has at the present time gone back to 15 per cent. Nevertheless, the total machine power represented by the orders received during the last two months has been as great as that received during six months of the pre-war year. This is mainly due to the fact that the whole of German industry is modernising itself more and more, in order to free itself as far as possible from the use of man-power. Further, the loss of the Saar district and of Upper Silesia has necessitated increased production on the part of our brown coal industry, as well as what remains of our pit coal industry. Consequently, all big machine factories, and some engine and boiler factories, are correspondingly busy, and in their turn are in a position to give orders to modernise their equipment. Further, as a result of the present brisk state of business in the textile and paper industry, considerable orders have been received by the electrical industry in respect of the modernisation of these works. It is difficult to state the prospects for the further development of the electrical engineering industry, since everything at the present time depends upon the exchange question. At the moment, thanks to the low value of the mark, our prices are still below world market prices, but a further increase in price will soon eliminate the now existing difference. In any case, the present demands for supply concentrated on a few months are unfavourable for the factories, and the recent disposition of the Government authorities is worthy of imitation, viz., that orders which are not absolutely urgent should not be given until the present boom is seen to slacken, in order that a more regular supply of work may be insured for the factories. The Saxon electrical engineering industry, which is represented by large firms such as the Sachsenwerk and Poege-Gesellschaft, and by various electro-chemical machine factories in Leipzig and numerous special factories which construct electrical apparatus, is doing equally brisk business as a result of the generally favourable boom. The profits of certain enterprises are unfavourably influenced by difficulties in the supply of raw material, concentration of orders on short terms, and on the other hand by continual demands for wage increases on the part of the workers, so that the difference between the cost of production and the sale price is constantly decreasing."

Italian Lamp Tax.—The *Gazette Ufficiale* (Rome) for November 23rd contains a Royal Decree-Law, dated November 16th, which prescribes Regulations regarding the taxation of electric light bulbs. The Decree provides that the manufacturing tax on electric light bulbs is fixed as follows for each bulb:—

(*a*) Incandescent electric light bulbs of any system:—

	With carbon filaments. Lire cts.	Other. Lire cts.
1. Up to 10 watts	0 25	0 50
2. From 11 to 50 watts	0 75	1 50
3. From 51 to 200 watts ...	1 50	3 00
4. From 201 upwards	3 00	6 00

(*b*) Arc lamps, excluding the carbons—3 lire.

(*c*) Carbons, pure or metallised, or of any other system, for arc lamps—2 lire per kg.

A surtax at the same rate is levied on such goods when imported from foreign countries. Goods manufactured for export are exempt from the tax. The date of enforcement of this manufacturing tax (and import surtax) is to be fixed by the Minister of Finance.—*Board of Trade Journal.*

We understand that this tax replaces the monopoly tax on electric lamps.

Chinese Notes.—Chen Pei-jen, Chu Chen-mu, Kiang Yun-shih, and Shen Wei-kun have organised the Tsung Sing Electric Company at Sin Chen, Kinhsin, with a capital of $25,000. Machines and plant are now being installed.

Chu Chi-chien is promoting a company to be known as the Peitaiho Hydraulic Electric Power Co., Ltd., at Peitaiho. Regulations have been drawn up and sanctioned by the Ministry of Agriculture and Commerce.

An electric company is being organised by some merchants in Tai Hsin, Kiangsu.

The Chusan Electric Light Company, at Chusan, Chekiang, has been registered by the Ministry of Agriculture and Commerce.

The Paoting Electric Company at Paoting, Chihli, has been registered by the Ministry of Agriculture and Commerce. A license of trade has also been given.

A proposal has been made by merchants to organise an electrical company in Shih Er-yu on the other side of the Yangtze River, opposite Chinkiang.

The Tsinan Telephone Company has increased its capital, and requested the Ministry of Agriculture and Commerce for registration.

Yih Tien-tsuen, an American returned student, has been appointed by the Ministry of Communications to install a long-distance telephone system between Nanking and Shanghai.

Price Fluctuations During 1921.—In their annual trade review for 1921 Messrs. Bolling & Lowe give tables showing the price fluctuations of materials which have been without parallel in the history of the trade. We extract the following figures:—

	Dec. 14th, 1920. per ton.	July 1st, 1921. per ton.	Dec. 13th, 1921. per ton.
PIG IRON—	£ s. d.	£ s. d.	£ s. d.
Hematite (East Coast) ...	13 5 0	8 0 0	5 2 6
Foundry (East Coast) ...	11 5 0	6 0 0	5 0 0
COPPER	75 15 0	71 5 0	67 0 0
TIN	212 10 0	167 0 0	171 10 0
LEAD	24 0 0	23 7 6	25 10 0
STEEL—			
Ship Plates	26 0 0	15 0 0	10 10 0
Angles	24 0 0	14 0 0	9 10 0
Bars	25 0 0	14 10 0	10 0 0
Joists	23 0 0	14 0 0	9 10 0
Heavy Rails	22 0 0	13 0 0	8 10 0

The above prices are for iron and steel of British manufacture, but all include delivery f.o.b.

Messrs. Bolling & Lowe say:—" We feel that an Irish settlement having been reached, the question of Germany's reparation payments receiving serious consideration, the Conference with regard to Universal Disarmament making progress, and also that prices of British iron and steel are likely to find a level at which competition from without need not be so greatly feared, the prospects for 1922, at any rate for the last six months of next year, are brighter than they have been of late, and we look forward with confidence to the future. The all-important necessities for national and personal economy and Government cessation from interference with trade still exist, if the country is to make the progress as foreshadowed."

Social Events.—The members of the Elliott Cricket Club held their annual dinner on the 10th inst. at the Sydney Arms, Lewisham. In the absence, through sickness, of the president (Mr. L. W. Smith), the chair was occupied by Mr. R. O. Smith, a vice-president of the club. Mr. E. J. Griffin, the chairman of the club, proposed the toast of " The Firm " (Messrs. Elliott Brothers (London), Ltd.), and in the course of his remarks he expressed regret that the wishes that he voiced last year for the continued prosperity of the company had not materialised; in fact, in all probability the year just past had been the worst in the whole history of the firm. The only consolation, if one could call it such, was that other firms engaged in the same industry were in a similar, or even worse, plight. In wishing for the future success of " The Firm " the members were wishing themselves success, because happier times for the directors meant happier times for employés. The cricket club had shown what could be achieved by hard work. If the *esprit-de-corps* displayed on the cricket field was carried inside the works it would assure the success of his toast—" The Firm." Mr. R. O. Smith, who responded in the absence of the president, said he felt sure that if any of the directors had been present they would have said the same as he was going to say. They were glad to see such gatherings in connection with the social activities at the works, and the cricket club had achieved the greatest success. Everyone of them would regret the bad time through which the industrial world was passing, but one could perceive a ray of hope for the future. Success was bound to come if they stuck together, for the best means to success was co-operation—the co-operation so well used on the cricket field. Mr. R. O. Smith proposed the toast of " The Club "; Mr. E. A. Wisdom replied, and, in doing so, referred to the successes achieved by the club.

During the evening the Friendly Team prizes were presented by Mr. R. O. Smith. The batting prize, presented by Mr. L. W. Smith, had been won by Mr. H. Mitchell, while the bowling prize, presented by Mr. R. Lawler, had been won by Mr. D. S. Greig. Mr. W. J. Coppin was at the piano, and the musical programme was well supported by Messrs. W. J. Woodman, Wal Currans, G. A. Morey, Fred Rampling, E. J. Griffin, B. Macnamara, W. Nicolle, and C. A. Smith.

The staff of Clyde Valley Electrical Power Co. held their annual dance on December 16th in the Grosvenor Restaurant, Glasgow. About 250 couples attended, and an enjoyable evening was spent.

The Belgian Electrical Market.—During the past twelve months business in Belgium in electrical machinery and appliances has been below normal, whilst German competition has also checked the sale of other imported as well as Belgian products. Dynamos and generators of German origin, reports the United States Commercial Attaché at Brussels, sell at prices 50 per cent. under American and 20 per cent. under Belgian quotations. Insulated wire and cable is made by a Charleroi concern at prices considerably under American quotations. The same is true of interior wiring supplies, and in this line German competition is active.

The use of arc lamps for illuminating purposes is comparatively small in Belgium, and the mercury vapour lamp is rarely seen. The Commercial Attaché adds that as no incandescent lamps are produced in Belgium, a large business in lamps with metallic filaments is done by Dutch companies, but local manufacturers affiliated with American interests are organising a local factory, and an extensive advertising campaign is being carried on to introduce a well-known American trademark. German incandescents are widely sold in Belgium. Meters and other measuring instruments of American manufacture are also subject to severe Belgian and German competition, the price ratios being practically the same as on machines. German bidders on a contract let by one of the larger communes of Brussels quoted prices 50 per cent. under those offered by American firms, while local manufacturers bid about two-thirds of the American prices. In motors the largest American concerns are having types up to 15 h.p. built by Belgian firms affiliated with them, and the same is true of small transformers. A good business is being done in switchboard apparatus, which, together with high-pressure switches, is the most active line in this industry. It is generally found that Belgian users of electrical machinery demand a higher external finish than American buyers, and are not so particular regarding internal construction.

An increased demand is noted for vacuum cleaners and electric flatirons, the majority of the former being of American manufacture, although some French models imitated from American types are seen in local shops. While numerous French, Italian, and Swiss manufacturers of small electrical cooking apparatus have agents in the larger Belgian cities, articles of this nature, owing to inferior merchandising and advertising, have never come into any considerable vogue. Small electric tea kettles sell for 110 to 130 fr. retail. Hot plates large enough to hold two or three dishes are priced at 275 fr. A considerable market has been created for small electric heaters suitable for use with ordinary household voltages. The favourite heater seems to be the radiant or headlight type, usually of French, Italian, or local construction, selling for 125 fr. and up, according to size. There is practically no demand for electric wringers and washing machines in Belgium nor for electric fans.

In Brussels, as the communes have separate lighting systems, there is no universal voltage. The commune of Brussels proper uses 110-volt current, and the immediate adjacent commune of Ixelles uses 220.

Protection for the Dutch Electrical Industry.—Electrical manufacturers in Holland have long been complaining of the effects of foreign competition emanating from countries having a depreciated currency. It is, however, only now that the Dutch Association of Electrical Manufacturers (Vereeniging van Fabrikarten op Electrotechnisch Gebiea) has ventured to approach the Minister of Trade and Industry on the question. In the course of a communication addressed to the Minister, the Council of the Association states that the prevailing abnormal circumstances render it necessary firmly to adhere to the legally fixed protection—which is very low and in general 5 per cent.—and not make it illusory in connection with the disastrous fall in exchange. For this purpose the Council submits that it is essential that the 5 per cent. import duty should be levied on an invoice amount calculated not according to the daily quotations, but according to the intrinsic value of the money in the country of origin, particularly Germany. Moreover, in special cases which may appear to the Minister to be necessary, the Council urges that the Minister should be armed with a general authority to impose a provisional import veto, as it is in the general interest of the country that the Dutch electrical industry should not be ruined.

E.P.D. Arrears.—In a speech at Newcastle on December 10th the Chancellor of the Exchequer (Sir Robert Horne), said he intended to propose to the House of Commons that outstanding arrears of Excess Profits Duty should, in cases which were found to merit the concession, be paid in quarterly instalments spread over a period of five years, the first instalment being payable before March, 1922. Another proposal was that interest payable in cash, at the net rate of 5 per cent. per annum, without allowance for income tax, shall be charged as from a fixed date on all outstanding arrears of E.P.D. as assessed, whether such arrears fall within the instalments scheme or not. Pending the assent of Parliament, the Chancellor had instructed the Commissioners of Inland Revenue to give effect as far as possible to his scheme, which was designed to assist industry in its present difficulties. Sir Robert said that the arrears had in many cases arisen out of no fault of the particular tax-payer who had burdened himself with larger factories or increased equipment, which, owing to depreciation in trade, he found it impossible to finance.

The Times, in referring to the subject on December 13th, said that the scheme outlined by the Chancellor had had a lukewarm reception in certain business circles. The scheme was criticised on the ground that the concession which was to be made had not been asked for, except by a small group, and would really be a greater convenience to the Chancellor than to the industry of the country.

A great many firms had already paid the duty, so the concession, it was claimed, was unfair as between firm and firm. Those who had paid had done so with money which was urgently required for business purposes. Many of the firms which had not paid could not pay without becoming bankrupt, and this concession was therefore more apparent than real; for the Chancellor, if he had tried to obtain their money more quickly, might lose it altogether.

The real apprehension was, however, that this concession; which by many firms was regarded as no concession at all, would be used to choke off other demands which were now becoming insistent. It was regarded as not without significance that the Chancellor should have made his announcement of the new scheme immediately after the statement had been made that the Federation of British Industries intended to press for the removal of the Corporation Tax and for the reduction of the Income Tax.

The president of the National Union of Manufacturers, Mr. George Terrell, M.P., said the relief which the Chancellor had granted would be welcomed with delight by many, and would be quite an aid in the revival of trade.

Trade Depression and Income Tax Relief.—Mr. W. R. Fairbrother, of 67 and 68, Cheapside, London, E.C., writes: "From the many accounts appearing in the Press it is obviously hoped that the Chancellor of the Exchequer will endeavour to lighten the burden of taxation in the near future. May I, therefore, suggest what, in my opinion, would prove beneficial in furthering the efforts to revive the nation's trade? The repeal of the well-known and helpful Sections 43 and 44 (which gave relief when profits or income had diminished in any year of assessment) as and from the year 1920-21, is now clearly seen to have been a mistaken policy. Had such relief been continued over the period of the war's "aftermath" the present acute depression might have been to some extent averted, and trade in the reconstruction period would not have been so injuriously and adversely hit by such high taxation. I would, therefore, urge that these two sections be re-enacted and made retro-active as and from the year 1920-21, which would have the effect of (1) allowing firms and companies an amended assessment based on the lower profits, and (2) giving an individual the basis of actual income instead of the higher statutory assessment."

An Australian Inquiry.—H.M. Senior Trade Commissioner in Australia reports that an important local departmental store is sending a representative to the United Kingdom, the Continent, and the United States with a view to purchasing a large variety of domestic, medical, and other electrical fittings and appliances suitable for a retail store. United Kingdom firms may obtain the name of the representative and the address in London to which communications should be sent against his arrival, on application to the Department of Overseas Trade.

Electric Heating Apparatus in Germany.—The Electro-Heating Co. has been formed at Nuremberg to combine the electric heating apparatus manufacturing departments of the A.E.G. and the Bing Works.

The A.E.G. in Austria.—It is announced from Vienna that the A.E.G., of Berlin, and the A.E.G.-Union Electricity Co., of Vienna, have entered into a closer community of interests for 30 years. For this purpose a new concern has been formed in Vienna under the title of the A.E.G.-Union Works, which will take over and considerably extend the existing Stadlau manufacturing works of the Vienna company in question. The share capital has been fixed at 500,000,000 kronen, of which the Berlin company and the Vienna company each will subscribe one half.

Unemployment.—The "live" registers of the employment exchanges in the United Kingdom showed a decrease, for the week ending December 9th, of 209, the total unemployed being 1,833,800. The *Morning Post* states that relief schemes submitted by local authorities to the Unemployment Grants Committee are being sanctioned so rapidly that there is a danger of the sum allocated for this purpose being exhausted soon. The 660 schemes sanctioned up to the end of last week represented an expenditure of £7,600,000. If all the schemes submitted are approved, an expenditure of £14,886,675 will be incurred.

British Empire Exhibition.—Lord Morris, Chairman of the Executive Council of the British Empire Exhibition, discussing the question of the guarantee in connection with the exhibition, said he was more than sanguine that by Christmas Day they would be within sight of the £1,000,000 guarantee. Only £125,000 was required. The completion of the guarantee fund would aid the Labour situation considerably. Thousands would be employed directly on the exhibition grounds and others elsewhere.—*Morning Post.*

Book Notices.—*A Catalogue of British Scientific and Technical Books.* — Pp. xviii+376. London: British Science Guild, 6, John Street, W.C. 2. Price 10s. net.—This catalogue, "covering every branch of science and technology, carefully classified and indexed," has been prepared by a committee of the British Science Guild, of which Sir Richard Gregory is chairman; Mr. J. S. Highfield, Mr. A. A. Campbell Swinton and Lt.-Col. W. A. J. O'Meara (hon. secretary of the Guild) are also members of the committee. The catalogue arises out of the collections of books shown at the British Scientific Products Exhibitions which the Guild organised in 1918 and 1919. It contains over 6,000 titles, classified under 50 main groups and nearly 500 sub-classes, each item including the author's name, title of book, size of page, number of pages, date of last edition, name of publisher, and the price. Following the main catalogue are a list of publishers, index of authors, and index of subjects. To this comprehensive and scientifically-compiled catalogue we offer the most cordial welcome; the want of it has long been felt—we are constantly receiving requests for advice regarding the choice of books, and shall find this volume, if only as a reminder, of great assistance. But it has other uses also, and we feel that the Guild by providing so excellent a guide to the rich store of British scientific literature has rendered most valuable service to science and industry alike.

The *Journal* of the South African Institution of Engineers. Vol. XX., No. 4, November, 1921.—This issue contains a paper describing the hydro-electric plant at Howick Falls, together with a discussion on the paper.

"Science Abstracts." Section A, Physics; and Section B, Electrical Engineering. Vol. XXIV, Part II. London. E. and F. N. Spon. Price 2s. 6d. net per section.

A G.E.C. Window Display.—An ingenious Christmas shop-window display has been arranged at Magnet House by the General Electric Co., Ltd. Santa Claus is seen pouring gifts into a chimney mounted on a snow-covered roof, and by means of hidden mechanism and flashing lights an illusion is presented which gives the impression of a constant stream of articles descending the chimney. Falling "snow" is kept in motion by hidden fans.

For Sale.—By direction of the Disposal Board, Messrs. J. Hindle & Son will sell by auction at Liverpool, Birkenhead, and Ellesmere Port, on January 10th and following days, plant, machinery, electrical equipment, office furniture, &c. For particulars see our advertisement pages to-day.

An Overcrowded Profession.—Messrs. Johnson and Phillips, Ltd., advertised recently for a boy for their Liverpool store-rooms, and met with a response from about 1,500 youths of various ages. Does this indicate the intensity of the present rush to enter the electrical profession?

The Burden of Taxation.—The Chancellor of the Exchequer is to receive a deputation from the Federation of British Industries early in the New Year, when the heavy burden of taxation on industry will be the subject under consideration. The Federation is calling for a reduction in the Income Tax and the removal of the Corporation Profits Tax.

The Cost of Living.—According to the *Labour Gazette*, the cost of living as at December 1st was 99 per cent. above the figure for July, 1914; a year ago the cost was 169 per cent. above. This is the lowest price level since May, 1918.

Local Electrical Exhibition.—An interesting exhibition is being held by the Burnley Electrical Maintenance Co. described as the "Hot-Point" appliance show; there are on view all manner of things for labour saving in the home.

Factory Premises for Disposal.—Messrs. Hillier, Parker, May & Rowden will sell by auction at the Grand Hotel, Bristol, on January 12th, factory premises, with possession, situated at Eastville, Bristol, with a floor area of 42,000 sq. ft., garage, loading dock, &c. (See our advertisement pages to-day.)

Copper and Lead Prices.—Messrs. F. Smith & Co. report December 20th:—Copper (electrolytic) bars, sheets, wire rods, and h.c. wire, no change.

Messrs. James & Shakespeare report, December 20th:—Copper bars (best selected), sheet, and rod, £98; £3 dec. English pig lead, no change.

LIGHTING AND POWER NOTES.

Australia.—The Morwell Scheme.—The Victorian Legislative Assembly passed a Bill on December 15th authorising the Electricity Commission to raise a loan of £2,000,000 in connection with the Morwell Brown Coal Scheme.—*Reuter* (Melbourne).

Aylesbury.—Loan.—The Town Council is applying for a loan of £2,000 for meters.

Ayr.—Reduced Charges.—The Corporation has decided to reduce the charge for electricity by 25 per cent.

Bangor.—Bulk Supply.—The City Council has decided to obtain a bulk supply of electricity from the North Wales Power Co., and application has been made to the Electricity Commissioners for sanction to borrow £9,000 to cover the estimated capital expenditure on installing the necessary plant, mains, &c.

Barry.—Gas *v.* Electricity.—Owing to the opposition aroused by its suggestion to spend £125,000 in improving the local gasworks, the Council has referred the proposal back to committee with instructions for the carrying out of further investigations regarding the cost of an electricity supply.

Bexley (Kent).—Revised Charges.—The Urban Council has discontinued the rateable value tariff for electricity, and in substitution has decided to charge 8d. per unit.

Brentwood.—Extension of Supply.—The Brentwood District Electric Co., Ltd., is applying for an order authorising it to supply electricity in the Brentwood urban district and in parts of Hutton, Ingrave, Shenfield, South Weald, and Great Warley.

Continental.—Italy (Sicily).—A number of schemes have been drawn up for the utilisation of the island's water power for generating electricity. As the largest rivers are greatly reduced during summer, every scheme involves the construction of large reservoirs. The following are among the projected schemes:—Upper Belice River, 4,000 h.p.; Tusa River, 1,700 h.p.; Imera River, 18,415 and 15,029 h.p.; S. Leonardo River, 5,215 h.p.; Belice River, 6,413 h.p.; Vedura River, 10,736 h.p.; Platani River, 3,500 and 10,960 h.p.; Naro River, 2,370 h.p. These are but a few of the many applications for concessions which have been put forward.

Austria.—The Wasserkraft-Aktiengesellschaft has been formed, with capital wholly subscribed in Austria, to carry out extensive works for the utilisation of water resources for the generation and distribution of electricity mainly for the benefit of Vienna. The capital is fixed at 500 million kroner, half of which is subscribed by the Vienna Municipality and half by leading banking firms. For the first portion of the programme 100 million kroner has been subscribed by the two groups named, and it is expected to be completed by the end of June, 1926. It comprises water-power stations on the Ybbs and along the watercourses stretching from Lunz and Kienberg-Gaming, and also long-distance mains and accessory installations. The second part of the programme will call for 6,400 million kroner, to cover which sum bonds will be issued. Work on the first part of the programme was to have been begun at the beginning of last month. As is usual in foreign concern of this kind, the concession is only a lease, in this case for 30 years, at the end of which period all the installations revert to the municipality.

Poland.—We learn from the *Elektrische Kraftbetrieb und Bahnen* that a group of the largest petroleum companies of Bryslav intend to set up a big electric power station conjointly, in order to carry out the boring and working of the petroleum fields. The Polish Ministry of Trade has promised its co-operation to carry out the work.

Czecho-Slovakia.—It is reported from Prague that the schemes of electrification prepared for the Ministry of Public Works have now assumed a definite form. They have originated from the consideration that, as submitted by experts, the coal resources of North-West Bohemia will be exhausted in from 70 to 80 years from the present time. It is therefore proposed to constitute a company at Prague under the title of the United Electricity Works for the construction and working of the following:—(1) A steam generating station in the district of the State mines near Hernewitz of a capacity of 45,000 kW, with a transmission line to Prague 62 miles long and a pressure of 100,000 volts, the expenditure being estimated at 300,000,000 crowns. (2) A hydro-electric works at Stjechowitz by the erection of a dam in the Moldau and capable of supplying 350,000,000 kWh per annum to Prague, the expenditure being computed at 450,000,000 crowns. (3) A hydro-electric works near Bramy at a cost of 80,000,000 crowns and an annual output of 41,000,000 kWh. The scheme provides for the first-mentioned works being completed in two years and the second and third in 1927.

Belgium.—Since the termination of the war there has been a marked increase in the demand for electrical energy for lighting and power purposes in the Brussels district. Thus, whereas in 1913 the output of the generating plants of the Société Bruxelloise d'Electricité only amounted to 9,500,000 kWh, it is expected this year to reach a total of no less than 20,000,000 kWh. In view of the additional contracts already entered into for supplies in 1922, the company is now taking the necessary steps to enlarge the capacity of its generating stations.

Sweden.—As there appears to be a scarcity of power in the South of Sweden, the Government auditors have brought forward a scheme for the utilisation of the surplus energy at the hydro-electric works at Trollhattan in conjunction with the South Swedish Power Co. Negotiations have been proceeding between the State Hydro-Electric Department and the company with a view to co-operation in the matter. It is suggested that the former should erect a high-pressure transmission line between Trollhattan and a place to be selected in the South of Sweden. The line is conceived

as an extension of the main line Alvkarleby-Trollhattan, which will soon be completed, and it would also come into consideration on a possible future transmission of power between the Scandinavian countries. It is estimated that the expenditure on the new line would amount to 7,000,000 kr.

Chester.—Loan.—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £14,000 for electricity purposes.

Fife.—Loan.—The Kirkcaldy Tramways and Electric Lighting Committee has decided to apply to the Electricity Commissioners for sanction to borrow £80,000 for the installation of two 2,500 kW turbo-alternators and the necessary mains and plant.

Glasgow.—Loan.—The Corporation is seeking power to borrow £115,000 for the extension of high-pressure feeder cables in connection with the transmission of electrical energy from the Dalmarnock power station.

Hereford.—Loan Sanctioned.—The Town Council has received sanction to a loan of £8,550 for mains and services.

India.—Shillong.—A scheme is under consideration to utilise the waters of two rivers in the neighbourhood of Shillong, Assam, for generating electricity for lighting and industrial purposes

Cossipore.—There will shortly be an addition to the generating plant at the Cossipore power station of the Calcutta Electric Supply Co. in the form of one Curtis 15,000 kW turbo-alternator and another of 6,000 kW similar to the one already in operation there. The British Thomson-Houston Co. has supplied these machines, and erection will be commenced early in January.

Isle of Wight.—Proposed Increase of Charges Opposed.—The local bodies in the Island are taking joint action to oppose the application of the Isle of Wight Electric Light Co. for a Special Order, which seeks to increase the price of electricity.

London.—Stepney.—Upon the recommendation of the Electrical Engineer (Mr. W. C. P. Tapper), the Finance Committee has approved the extension of the Limehouse generating station, subject to the payment by the Unemployment Grants Committee of half the interest charges for the first five years; to the Electricity Commissioners' sanction to a five-years suspension of repayment; and to the same applying to sanctions already received but not exercised.

Fulham.—The Electricity Committee reports the receipt of the Electricity Commissioners' sanction to borrow £11,124 for the purpose of mains extensions. As the Unemployment Grants Committee required the Council to undertake that no more than 75 per cent. of the standard rates should be paid to unemployed men engaged for this purpose, the Council has decided to proceed with the work at once without further regard to assistance from the Grants Committee.

L.C.C. and Smoke Nuisance.—The Public Control Committee of the L.C.C. states that in spite of warnings the nuisance of smoke from the generating stations of the Hammersmith and Islington Borough Councils continues. It accordingly recommends that, subject to the consent of the Ministry of Health, legal proceedings be instituted against the two Councils.

Nelson.—Loan.—In order to provide work for the unemployed, the Town Council has decided to apply to the Electricity Commissioners for sanction to the borrowing of £8,458 for mains and services.

New Zealand.—Loan.—A Bill authorising a new loan of £5,000,000, to be borrowed in London, was introduced in the House of Representatives on December 10th. Mr. Massey, the Prime Minister, explained that the money was required for development works, such as hydro-electricity, railways, roads, and the opening up of new lands. It is not proposed to raise the loan until the next financial year.—*Reuter* (Wellington).

Northallerton.—Reduced Charges.—The Electric Light Co. has reduced the charges for public lighting from 7s. 6d. to 7s. 3d. per lamp per 100 hours.

Northampton.—Reduced Charges.—The Electric Light and Power Co., Ltd., has reduced the initial price of electricity for lighting purposes by ½d. per unit; the rent of hired motors by 10 per cent.; and for heating the charges will be reduced by the introduction of the following scale of discounts:—100 units per quarter, 5 per cent.; 200, 10 per cent.; 300, 15 per cent.; 400, 20 per cent.; 500, 25 per cent.

Paisley.—New Power Station.—Messrs. J. & P. Coats, Ltd., thread manufacturers, Paisley, are to erect at their Ferguslie Mills a large electric power station, which is to cover a considerable area. The station will consist of a power house 150 ft. by 65 ft., a boiler house 90 ft. by 55 ft., and a pump house 52 ft. by 36 ft.

Loan.—Application is being made by the Town Council to the Electricity Commissioners for sanction to borrow £30,000 for the installation of new plant and mains.

Runcorn.—Order Revoked.—The Minister of Transport has revoked, as from December 10th, the Runcorn Urban and Runcorn Rural Electric Lighting Order, 1910, as to so much of the area of supply as is included in the parishes of Appleton, Grappenhall, Latchford Without, Stockton Heath, Higher Walton, Lower Walton and Thelwall.

Rushden.—Reduced Charges.—The Electric Supply Co., Ltd., has reduced the charges for electricity for power and heating by ½d. per unit.

Scarborough.—Price Increase.—The Scarborough Electric Supply Co., Ltd., is applying to the Electricity Commissioners for authority to increase the maximum charges.

Sevenoaks.—New Plant.—The Sevenoaks and District Electricity Co., Ltd., is installing a 200-kW alternator in its works. The engine, which is being supplied by Messrs. Mirrlees, Bickerton & Day, is of the six-cylinder Diesel type.

Sherborne.—Order Revoked.—The Minister of Transport has revoked the Sherborne Electric Lighting Order, 1912, as to the whole of the area of supply as from December 10th.

Shrewsbury.—Loan.—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £2,650 for electricity purposes.

Spalding (Lincs.).—The Urban Council has refused to grant permission to the South Lincs Agricultural Co. to supply electricity to the residents close to the works.

Torquay.—Purchase of Undertaking.—The Town Council has ratified the negotiations with Newton Abbot Urban Council in connection with an electricity scheme, under which the undertaking at Newton is to be acquired either by the Urban Council or jointly with Torquay, and Newton will be supplied with electricity at 10d. per unit instead of 1s. as at present. The cost of the electricity works at Newton is £65,000.

Walton-on-Thames.—Electricity Extensions.—It was reported at a recent meeting of the Urban Council that the Electricity Company, having obtained an order increasing the price of energy, intended to proceed at once with improvements for the supply of electricity at an estimated cost of £15,000.

Waterford.—Proposed Electricity Scheme.—The Electric Lighting Committee has instructed an engineer to prepare a new scheme of public and private electric lighting for the city.

Weybridge.—Protest Against Increased Charges.—The Urban Council has decided to send a protest to the Ministry of Transport against the granting of an Order to the Electricity Co. increasing the price of electricity to 1s. per unit, with a minimum charge of 15s. for each winter quarter and 10s. for each summer quarter. A protest has also been lodged by the Walton-on-Thames Urban Council.

Whitehaven.—Loan.—The Town Council has applied for a loan of £8,500 for boilers, super-heaters, stokers, pipework, feed pump, and extensions to the economiser. There is to be a small reduction in the charges for energy as from the New Year.

Wicklow.—Electricity Supply.—Owing to the cost of gas, the Council has under consideration a proposal for the supply of electricity to the district.

Worthing.—Extensions.—Extension of plant at an estimated cost of about £17,000 has been decided upon by the Town Council on the advice of the resident electrical engineer (Mr. Geoffrey Porter). The latter considers it essential that this extension should be taken in hand without delay in order to safeguard the supply during the winter of 1922-23, and he proposes the provision of a further 500-b.h.p. Diesel engine with a 350-kW generator. This will increase the total capacity of the undertaking to 1,460 kW.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The Legislative Assembly has passed a Bill authorising the inauguration of electric railless trolley systems in the outer suburbs of Melbourne.—*Reuter's Trade Service* (Melbourne).

Sydney Railway Extensions.—City railway extensions, estimated to cost £4,500,000, are to be proceeded with in Sydney, New South Wales, in order to relieve the existing rail and tramway services. In 1905 the tramways on the southern shore of Sydney Harbour carried 120,973,934 persons; in 1920 the number had risen to 269,255,033. Directly and indirectly the extensions authorised should provide employment for 5,000 men.

Bradford.—Application for Provisional Order.—The Parliamentary Sub-Committee of the Finance Committee has recommended that application be made to the Ministry of Transport for a Provisional Order authorising the Corporation to use railless trolley vehicles on any route within or outside the city, and for power to remove the existing limit of five tons, imposed by the Bradford Corporation Act, 1910, on trolley vehicles used on the routes already adapted to these cars and on the new routes proposed.

Loan.—The Tramways Committee has decided to apply for sanction to the borrowing of £450,000 for track renewals, &c.

Brazil.—Railway Electrification.—The freight locomotives recently shipped by the Westinghouse Electric & Manufactruing Co. to the Paulista Railways of Brazil, are now in service in that country between Jundiahy and Louveira. These are the first electric locomotives to be used in Brazil. The new locomotives haul trains of from 43 to 45 "units" over grades up to 1.5 per cent. The so-called "unit car" is of 10 tons gross weight, and the term refers to the old wooden car of 30 years ago. Modern cars are said to be two, three, or four units, according to their size and load. Thus a train of 45 units represents 450 tons weight, and is approximately 675 ft. in length. Under former steam operation such trains could not be hauled over a 1.5 per cent. grade at a speed greater than 15 kilometres per hour. The Westinghouse locomotives ascend such grades at 45 kilometres per hour, which means trebling the capacity of the track and greatly increasing the speed of handling freight shipments.

London.—Compensation for Underground Railways.—Under the scheme of compensation for the retention of railways by the Ministry of Transport during the war period, the Metropolitan Railway receives £211,950 and the Metropolitan District Railway £197,597. The awards are based on the net receipts in 1913.

Effect of Reduced Fares.—The report of the L.C.C. Highways Committee upon the first week's working since the introduction of lower fares, shows that, while the number of passengers carried rose from 12,037,284 to 13,286,976, the revenue fell from £91,712 to £89,814. The question of further fare reductions is to be postponed until the end of the financial year.

Scarborough.—Closing of Tramways.—A conference of representatives of the Corporation, the Tramway Company, and the Ministry of Transport has recently been held to discuss the tramway undertaking, and it has been decided to cease running the cars at the end of this year.

The Tramwaymen's Agreement.—Sub-Committee Appointed.—In accordance with a recommendation from the Municipal Tramways Association, the National Joint Industrial Council for the Tramway Industry on December 15th appointed a sub-committee to review the terms of the agreement arranged in March, 1919. Mr. J. Beckett states in this connection:—"The Council have not committed themselves to retain in the agreement the guaranteed 48-hour week over which the whole of the trouble has arisen. The guaranteed week will be reviewed by the sub-committee in common with the other clauses in the agreement. The committee will meet at once and report to a special meeting of the Industrial Council in February."

Wigan.—Mails on Tramways.—The Wigan Tramways Committee is to receive the sum of £500 per annum for the carriage of mails and postmen on the electric tramcars.

Wolverhampton.—Fares.—At a meeting of the Town Council on December 12th an alteration of the 2d. minimum fare, for short distances, was advocated. The Tramways Committee considered this impossible, as the revenue was at present just about equal to the expenditure.

York.—New Depot.—The new tramway depôt is expected to be open for use before Christmas.

TELEGRAPH AND TELEPHONE NOTES.

Czecho-Slovakia.—Service Extensions.—At a conference dealing with the proposed increase in the telegraph and telephone tariffs the representatives of the Czecho-Slovak Ministry of Posts stated that during the last three years 8,417 kilometres of telegraph lines and over 1,300 kilometres of telephone lines had been installed in Czecho-Slovakia. Preparations are being made for the construction at Prague next year of automatic telephone exchanges.—*Reuter's Trade Service* (Prague).

China.—Wireless Telegraphy.—Introducing a resolution at the December 12th meeting of the Committee on Pacific and Far Eastern questions at Washington, M. Viviani, the principal French delegate, emphasised the necessity of superseding competition by co-operation in the establishment of wireless communications between China and other countries. He urged the appointment of a committee composed of representatives of the Powers interested, and of China, which would act on the following principles: The better utilisation of capital, personnel, material, and wave-lengths. China shall possess as soon as possible her own wireless plant equipped with all the latest technical improvements available. The internal wireless communications of China shall be operated in accordance with Chinese law, whilst her foreign communications shall be dealt with by an International Convention. The Governments interested shall in no way support companies or persons who do not comply with the principles and regulations based upon the recommendations of the above-mentioned committee. Government and Press messages shall be granted a reduction of at least 50 per cent.—*Daily Telegraph.*

Germany.—Wireless Telephony.—Experiments are being made with a newly-invented apparatus, fixed on the express trains running between Berlin and Hamburg, by means of which, it is claimed, wireless telephone messages can be dispatched and received while the train is in motion. It is stated that the experiments have been successful, and that as soon as apparatus can be made and installed, it will be possible for travellers on the expresses to speak with any subscriber on the telephone system of Hamburg or Berlin. Should this venture prove remunerative similar arrangements will be made for travellers on other long-distance trains.—*Morning Post.*

The Pacific Cable.—Duplication Approved.—The Australian Federal Government has approved the duplication of the Pacific telegraph cable. As it is understood that the other governments concerned have assented to the scheme, and as funds to cover the cost are available from the Pacific Cable Board's reserves (as we recently announced), there seems to be nothing to prevent the immediate initiation of the work. The proposed route of the duplicate cable will be a considerable modification of the existing one; the line is to go *via* Auckland (N.Z.) and Suva (Fiji Islands) instead of by Norfolk Island, and will proceed to Fanning Island and Honolulu instead of to Bamfield, which will result in a shorter route. It is proposed to connect Samoa to the new cable.

Telephone Service.—Corrupt Practices.—At the Guildhall on December 16th, F. A. Oppenheim, managing director of the Trade & Finance Syndicate, was summoned under the Corrupt Practices Act for giving £3 to H. W. Camp, assistant traffic superintendent, as an inducement to show him favour in obtaining better telephone service: Ald. Sir Vansittart Bowater took a serious view of the case and imposed a £20 fine.

Wireless Telegraphy.—Proposed Station at Barry.—The Cardiff Chamber of Commerce is to send a deputation in company with representatives of the Newport Chamber of Commerce to the Postmaster-General to urge the establishment of a wireless station at Barry. Mr. R. O. Sanderson, the president, who introduced the subject, mentioned that pleasure steamer companies had been compelled by legislation to install wireless apparatus on their vessels, and they felt that if their steamers were dependent upon assistance reaching them from the present stations (the nearest one of which was Poldhu, Cornwall) the result might be disastrous. The necessity for a wireless station in the vicinity was emphasised by a mishap which occurred during the summer on the Welsh grounds, and assistance could have been on the way in a few minutes if there had been a wireless station at Barry.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—February 1st. Victorian Government Railways. Four motor-driven grinding machines, with accessories.*

February 15th. Postmaster-General's Department. Telephone apparatus and parts (Schedule 544). (December 9th.)

Belgium.—December 28th. Belgian Ministry of National Defence, 10, Rue de Meridien, Brussels. Miscellaneous materials, including 1¼ tons of bronze wire, 13,000 double-bell insulators, and 272 head fittings with two ear-pieces for listening to and receiving wireless telegraph messages. Particulars (3 francs) from 15, Rue des Augustins, Brussels.

Government.—December 29th. According to the British Chamber of Commerce in Belgium, there is to be a public adjudication for an electric light installation at the Military Depot of St. Bernard (Hemixem), and the matter is open to competition from both Belgian and foreign firms. Amount of contract: Fr. 127,615. Deposit: Fr. 12,800. Specification (4 fr.) and plans (2 fr.) can be obtained at the Musée Commercial, 15, Rue des Augustins, Brussels.

Bulgaria.—February 10th. Bulgarian Post and Telegraph authorities in Sofia. Two thousand sets of telephone receivers and transmitters with accessories.

Bradford.—December 24th. Electricity Department. Rotary converting plant (Cont. R.207.) (December 9th.)

Chile.—February 4th. State Railways. Twelve windmills, complete; one electric compressor; one air-storage drum and d.c. motor; 1,300 metal filament lamps for lighting locomotives; 38 wall telephones.*

East Ham.—January 12th. Electricity Department. One 1,500-kW converter, either rotary or motor type; e.h.p. and l.p. switchgear and connectors. (See this issue.)

France.—January 16th. The French Post, Telegraph, and Telephone Authorities at Rabat. Eighty tons of copper wire, 3 mm. dia.

December 29th. French Ministry of the Colonies, 27, Rue Oudinot, Paris. Fifteen tons of copper wire.

London.—SHOREDITCH.—January 3rd. Electricity Supply Department. One water-tube boiler of 33,000 lb. evaporative capacity. (December 9th.)

L.C.C.—January 12th. One electric passenger lift, capacity 11½ cwt., with full automatic push-button control, to be completed within two months, at Geoffrey House, Tabard Garden Estate, Bermondsey, S.E. (December 16th.)

Manchester.—January 5th. Corporation. For Barton power station. Standard gauge railway, 2-way turntables (two of 20 tons and two of 40 tons capacity). Specifications, &c., from Mr. F. E. Hughes, secretary Electricity Dept., Town Hall. Déposit £1 1s. (returnable).

New Zealand.—WELLINGTON.—January 17th. Post and Telegraph Department, 25,000 dry cells for telephone work.*

Peterborough.—January 12th. Electricity Department. One 3,000-kW turbo-alternator with condensing plant, two 750-kW rotary converters, two 100-kW motor generators, e.h.p. and l.p. switchgear, steam, water, and drain pipes, foundations for the above plant, and structural alterations to existing buildings. (December 16th.)

South Africa.—JOHANNESBURG.—January 4th. Municipal Council. Two 2,000-kW converters, with switchgear and spares.*

January 18th. 372 consumers' watt-hour meters, including 37 d.c. meters, 275 single-phase, 50-cycle induction type meters, and 60 3-phase, 50-cycle, induction type a.c. meters for unbalanced leads.*

PRETORIA.—February 1st. Public Works Department. Conduit and conduit fittings. Electrical Engineer, Public Works Department, Pretoria.

PORT ELIZABETH.—January 31st. Municipal Council. Tenders for electrical plant.*

Spain.—February 1st. Harbour Works authorities at Vigo. Supply and erection of a 15-ton electric crane. Particulars from the Junta de Obras del Puerto de Vigo.

Uruguay.—MONTE VIDEO.—December 30th. State Electricity Department. Power station plant: one 4-stroke Diesel engine, coupled to a 200-kW, 3-phase alternator, and one 4-stroke Diesel engine, coupled to a 300-kW, d.c. generator.*

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—Belgian State Railways. Electrical Department, Brussels. 472 kilometres of electric cables in connection with the electrification of the lines at present in progress. Several firms competed, including one Austrian and one Italian, but in all cases the lowest price quoted was that of the Société des Cableries de et à Eupen.

Bolton.—Tramways Committee.—Accepted:—
Electric tramcar equipment, spare parts.—English Electric Co., Ltd.

Japan.—The Westinghouse Electric International Co. has received from its Japanese agent, Takata & Co., an order from the Daido Electric Power Co., of Japan, for electrical apparatus for two large hydro-electric plants, the total value of the order being about $2,000,000. The foregoing are to form a part of a super-power system for the Tokio district, and energy is to be transmitted at 154,000 volts.

London.—FULHAM.—Electricity and Lighting Committee. Supply of h.p. cable.

Enfield Ediswan Cable Works, Ltd.	£4,345
Henley's Telegraph Works Co., Ltd. (recommended)	**£4,400**
Nordiske Kabel Og Traadfabriker, Ltd.	£4,500
Hackbridge Cable Co.	£4,563
Siemens Bros. & Co., Ltd.	£4,590
Brit. Ins. & Helsby Cables, Ltd.	£4,593
Johnson & Phillips	£4,600
Western Electric Co., Ltd.	£4,620
Nederlandsche Kabelfabriek	£4,629
Pirelli Co.	£4,651
Callenders, Ltd.	£4,664
Watshams	£4,740
Union Cable Co.	£4,752
P. W. Snelus	£4,961
R. R. Todd	£5,000
Macintosh Cable Co.	£5,100
Electrical Engineering & Equipment	£5,225
W. T. Glover & Co., Ltd.	£5,280
Dieny & Lucas	£5,500
Mica & Micanite	£5,500
Thompson & Co.	£6,336
New Gutta Percha Co., Ltd.	£7,051

STEPNEY B.C.—Electricity Supply Committee.

Steelwork for lift well at Osborn Street sub-station, £89.—**Drew-Bear, Perks & Co., Ltd.** (recommended).

120 tons Highley Mining Co.'s d/s nuts, 33s. 9d. per ton.—Harper and Christopher, Ltd. (accepted).

Well and pipework at Limehouse generating station.

Perry & Co. (Bow), Ltd. (recommended) ...	**£26 226**
J. Cochrane & Sons, Ltd.	£22,100
J. Mowlem & Co., Ltd.	£27,400
Walter Scott & Middleton, Ltd.	£28,500
Whittaker, Ellis, Ltd.	£32,195
S. Pearson & Son (Contracting Dept.), Ltd.	£32,500

ST. PANCRAS.—Electricity and Finance Committee's building work in connection with the extension of the engine room at King's Road Station. Somerville & Co. £31,300. Time to complete 6½ months. Recommended, subject to the sanction of the Electricity Commissioners to the increased expenditure. (Twenty-four tenders were received.)

Coal for the electricity undertaking. Accepted:

500 tons Bentinck Derby slack, 23s. 10d. + 3s. 6d. ton cartage.—A. Blackman & Co.

1,000 tons Bentinck Derby slack, 27s. 4d. ton; 1,000 tons Pinxton Low main slack, 27s. 4d. ton; 200 tons Ramcroft hard steam coal, 37s. 11d.—J. H. Beattie & Co., Ltd.

100 tons Russell Black Vein washed nuts for continuing the special trial on No. 1 Niclausse boiler, 41s. 8d. ton + 3s. 6d. ton cartage.—Harper and Christopher, Ltd.

200 tons Shipley Through coal, 24s. 2d. + 3s. 6d. ton cartage.—Rose, Smith and Co.

Whitehaven.—Electricity Committee.

Two boilers, super-heaters, stokers, pipework, &c.; feed pump for the electricity works, £7,295.—Babcock & Wilcox, Ltd.

The following also quoted:—British Niclausse Boiler Co.; Clarke, Chapman & Co.; Clayton & Shuttleworth; Ransome, Sims & Jefferies; Richardsons, Westgarth & Co.; Spearing Boiler Co.; J. Thompson Water Tube Boilers, Ltd.; Vickers, Ltd.

Extension of the economiser, £298.—E. Green & Son, Ltd.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Christmas Lectures on "Electric Waves and Wireless Telephony," by Prof. J. A. Fleming, F.R.S. At Albemarle Street, Piccadilly, W.:—
I. Thursday, December 29th, at 3 p.m. "Surface Waves on Liquids."
II. Saturday, December 31st, at 3 p.m. "Waves in Air."

Salford Technical and Engineering Association.—Monday, December 26th. At the Royal Technical College. At 7 p.m. Annual social.

Electrical Power Engineers' Association (Southern Division).—Thursday, December 29th. At the Central Hall, Westminster. At 7 p.m. Lecture on "British Practice in High Tension Distribution," by Mr. P. V. Hunter.

Manchester Wireless Society.—Thursday, December 29th. At the Albion Hotel, Piccadilly, Manchester. At 8 p.m. Paper on "Selenium Cells: Their Construction and Application," by Mr. J. McKernan.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

AMONG the inquiries of this week we have been unable to trace the suppliers or manufacturers of:—

THE PERKINS ROTARY SWITCH, with on and off indicators.
HALEX accumulators.
WIZARD dust extractor.
BELLA flashlight table lamp.

NOTES.

"A Merry Christmas!"—We wish all our readers "A Merry Christmas." Business has been trying to everybody during the past few months—full of anxiety and uncertainty, and it will do us all good to get away from it and enter into the festivities of Christmas with pre-war enthusiasm. "All work and no play makes Jack a dull boy," and we do not want any dull boys in the electrical world in the year 1922, so let us enter upon the Christmas season meaning to enjoy it by forgetting some of our own affairs, by adding to the general spirit of peace and goodwill, and by lending a helping hand to some of those who through unemployment and other distresses are hard up against the conditions of the moment.

Summer-Time.—Mr. Shortt (Home Secretary) stated in the House of Commons on December 15th that a conference had recently been held with representatives of the French and Belgian Governments, and an agreement was reached that the summer-time period should commence on the night of the last Saturday in March, or the last Saturday but one in March when the last Saturday is the day preceding Easter Day, and end on the night of the first Saturday in October. The Government, in view of the serious inconvenience at present caused by the difference between the three countries in the dates of commencing and ending summer-time, had approved the proposal, which corresponded very nearly to the dates which had been fixed in this country.—*Daily Telegraph.*

Ediswan Factory Occupied.—According to the *Daily Herald*, the Edison Swan Co.'s lamp works, at Ponders End, were occupied by a body of 300 unemployed men on December 15th. The reason for the step was stated to be that the company was carrying on systematic overtime, 780 employés being employed in this way. Upon the company's undertaking to put an end to this, the men withdrew without doing any damage.

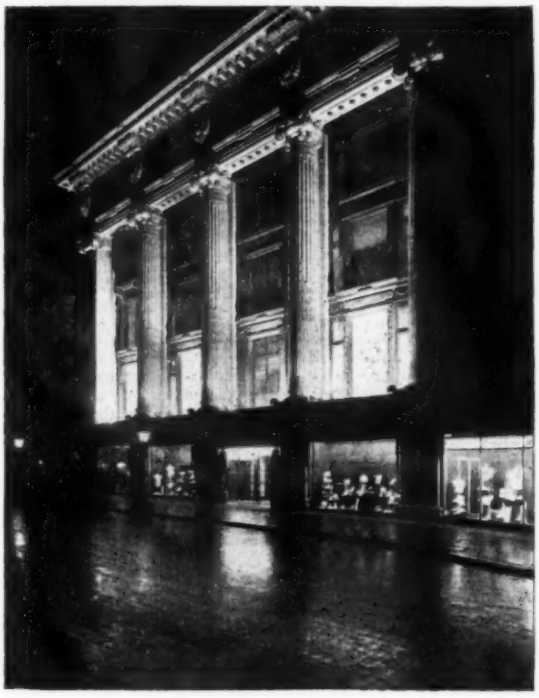
The I.M.E.A. 1922.—The 1922 I.M.E.A. Annual Convention will take place during the third (full) week in June, 20th—23rd June, inclusive, in Wolverhampton and neighbourhood.

"Beama" Scholarships.—The British Electrical and Allied Manufacturers' Association has, on the recommendation of its Education Committee, recently granted the following scholarships, each tenable for one year and each carrying a maintenance allowance of £100 and the payment of college fees:—

In Electrical Engineering (*Steam Turbo-generators*).—L. H. L. Badham (tenable at the City and Guilds [Eng.] College, South Kensington); J. H. Butcher (tenable at the City and Guilds [Eng.] College, South Kensington); J. E. Macfarlane (tenable at Brighton Technical College).

In Mechanical Engineering (*Steam Turbines*).—W. S. Bowers (tenable at Finsbury Technical College); J. A. Snape (tenable at Manchester College of Technology); M. L. Yates (tenable at Manchester College of Technology).

Lighting Large London Stores.—That the proportions and architectural embellishments of buildings need not be hidden as soon as evening sets in is demonstrated by the first section of the new Selfridge Building, where a complete system of



Exterior Lighting.

"flood-lighting" has been recently installed. We are able to reproduce a view of the building taken at night, and the way in which the details of the columns and cornices are thrown into relief is particularly striking. The "flood-lights" are of a standard design, and consist of a solid copper body lined with sectional parabolic reflectors of mirror glass. They are equipped with 400-watt Osram gasfilled projection-type lamps, with specially concentrated filaments. The installation was designed by the General Electric Co., Ltd., and is the first example of "flood-lighting" as applied to large London stores.

Pacific Cables.—Reuter's Agency is informed (December 14th, 1921) that the negotiations between the United States and Japan have led to an agreement being reached between them with respect to the Island of Yap and other mandated islands in the Pacific Ocean north of the Equator. The points of the agreement are as follows:—

1. The United States shall have free access to the Island of Yap on a footing of entire equality with Japan, or any other nation, in all that relates to the landing and the operation of the existing Yap-Guam cable or of any cable which may hereafter be laid by the United States or its nationals.

2. The United States and its nationals are to be accorded the same rights and privileges with respect to the radio-telegraphic service as with regard to cables. So long as the Japanese Government shall maintain on the Island of Yap an adequate radio-telegraphic station, co-operating effectively with cables and with other radio stations on ships and shore, without discriminatory exactions or preferences, the exercise of the right to establish radio-telegraphic stations at Yap by the United States or its nationals shall be suspended.

3. The United States shall enjoy on the Island of Yap the following rights, privileges, and exemptions in relation to electrical communications: (*a*) Rights of residence without restriction and of acquisition and enjoyment and undisturbed possession upon a footing of entire equality with Japan or any other nation of all property and interests, both personal and real, including lands, buildings, residences, offices, works and appurtenances. (*b*) No permit or licence to be required for the enjoyment of any of these rights and privileges. (*c*) Each country to be free to operate both ends of its cables, either directly or through its nationals, including corporations and associations. (*d*) No cable censorship or supervision of operations or messages. (*e*) Free entry and exit for persons and property. (*f*) No taxes, port, harbour, or landing charges or exactions, either with respect to the operation of cables or to property, persons or vessels. (*g*) No discriminatory police regulations.

4. Japan agrees that she will use her power of expropriation to secure to the United States the needed property and facilities for the purpose of electrical communication in the island, if such property or facilities cannot otherwise be obtained. American property and facilities for the purpose of electrical communication in the island are to be exempt from process of expropriation.

A formal convention will be drawn up for signature and will be subject to ratification by the Senate.

The Times says that by the agreement the U.S.A. obtains the right to use the Yap-Shanghai cable for messages to Japan and also the use of the cable to the Dutch Indies.

An "Underground" "Speeding-up" System.—The Underground railway authorities have installed a system at their Kilburn Park station, calculated to expedite the passage of travellers past the booking office. The "passimeter" system, as it is called, involves the use of three separate cyclometers, two automatic and one non-automatic. The first registers, dates, and cancels each ticket, and the passenger passes through an ordinary turnstile adapted to operate the second meter. A third cyclometer is used by the booking clerk to record the number of season-ticket holders passing the barrier. The system permits the traveller to pass straight through to the platform, thus saving a great deal of time during the "rush" periods. The "passimeter" system is used in conjunction with the automatic ticket-issuing device mentioned in our columns a short time ago. This is operated by the booking clerk pressing buttons, thus releasing any number of tickets at once, up to five. Five magazines, containing tickets of different prices, are provided. The pressing of a button starts up a small electric motor, which revolves drums upon which are projections that pick up the number of tickets required in a strip. The strip is then brought up through a slot near the pigeon hole and a knife attachment cuts them off. The number of tickets issued through each slot is automatically registered, and later designs of the machine will have a dating attachment.

Electrically-equipped Furniture.—The November issue of the National Electric Light Association *Bulletin* contained a well-illustrated article on the practicability of electrically-equipped furniture. Mention is made of exhibits of this nature at the recent New York Electrical Show, and the illustrations show a number of examples. Amongst these is a table, intended for a breakfast or dining room, equipped with two "outlets" neatly fixed to the edge of the table-top, from which short lengths of "flex" are taken to a toaster and grill or other appliances. Connection to the house wiring is made by means of a floor outlet. The overhanging table-cover common in this country is of course done away with

An Electrically-equipped Dressing Table.

and a smaller one substituted. A dressing table, shown in the article, and which we reproduce, is provided with wiring and outlets for curling tongs, hair dryer, and vibrator. The electrical fittings do not detract from the appearance of the table. A picture of a bed appears; this has a light fixed on either side of the head, as well as a heating-pad connection. There is apparently a great deal to be done in this direction. In this country the tendency has been to build special furniture for electrical equipment.

Newcastle Housing Exhibition.—The recent Housing and Home Life Economy Exhibition that was held at Newcastle-upon-Tyne from November 18th to December 3rd, 1921, proved a great success, the central feature being the stand of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and associated companies.

An attempt to get away from the usual type of exhibition stand was made by dividing the stand into three portions, on the first of which was erected a half-timbered model house, with roof, containing a dining room and bedroom furnished and decorated to illustrate the artistic effect of electric lighting, and containing electrical heating and lamp-holder apparatus; the second portion was used for showing fittings, heaters, and small cooking apparatus, the third portion being fitted up as an electric kitchen.

The dining room, with latticed windows and stained oak beam ceiling, was furnished in Jacobean style, the fireplace being tiled and containing a "Magicoal" fire. The lighting was by an Italian mosaic bowl fitting and a handsome ebonite standard lamp. On the table were shown an electric toaster, coffee percolater, and kettle, and on the mantelshelf was an oak-cased electric clock. The bedroom was decorated in white and blue with oxy-silver electric light fittings and heater. Two types of bedwarmer were shown on the bed, over which was a pendant light with a push-button switch.

In the central portion of the stand various two-light wall bracket fittings were shown on the dividing wall, and bowl fittings suspended from the ceiling. Here were also immersion heaters, grillers, kettles, irons, hair-driers, massage sets, a sewing machine with motor, and electric heaters, and electric clocks with electric control. A wireless telephone receiving set was installed in one corner and proved a great attraction, music and speech being transmitted from another part of the hall.

The remaining portion of the stand was fitted as a kitchen complete with a sink, water supply, electric wash-boiler, and electric hot-water supply, and contained electric washers, dish washers, and electric cookers. Continuous demonstrations were given with all the apparatus. The cooking always drew a crowd, and on one side of the stand clothes were washed in an electric washer, dried and ironed, and on the other side electric dish washers were shown in use. The hot-water circulator and wash-boiler were supplied by Messrs. Watson Norris, Ltd., of Wallsend; the cooking was carried out on a Jackson No. 20 Cooker; the washing machine used was a "Universal"; and the dish washers shown were of the "Western Electric" and the "Whirlpool" types.

The whole of the stand was wired with "Stannos" wiring and a considerable amount of business was done at the exhibition. A great advantage of the stand was that the domestic uses of electricity were demonstrated to many who could not be reached by any other method of advertising.

The Newcastle-upon-Tyne Electric Supply, Co., Ltd., also furnished the full electrical equipment for the caterers of the restaurant that was attached to the exhibition, which gave entire satisfaction. The plant consisted of one large double oven, two oval fish friers, two grillers and toasters, and two water urns, all of which were made by the Jackson Electric Stove Co., Ltd.

An Electrically-driven Ship.—Considerable interest was taken at Liverpool recently in the new electrically-driven Swedish vessel *Mod*, which, whilst in port loading up with cargo, was inspected by Prof. Abell, Dr. Marchant, Prof. Watkinson, and the staff of the Faculty of Engineering, Liverpool University. The installation consisted of two boilers, burning coal under a forced draught, and supplying steam at 200 lb. pressure to two Ljungstrom turbo-alternators, which occupy positions that would have been filled, in the case of a twin screw steamer, by the port and starboard turbine sets. A condenser is fixed under each turbine, and also electrically-driven wet and dry air pumps and a feed-water heater. Running at 4,200 r.p.m., each main generator is calculated to develop 600 kW at 900 volts, 70 cycles, 3-phase. The 3-phase slip-ring propelling motors, when running at 750 r.p.m., give a propeller speed of 75 r.p.m., and the speed of the *Mod* is nearly 12 knots. As to the controls of the vessel, a hand wheel operates the main switchgear, whilst two field-regulating switches vary the voltage of the generators. A steam-driven set generates direct current at 110 volts for lighting purposes. With the exception of the bilge pump all the engine-room auxiliaries are electrically driven by 3-phase power from the main generators. It was demonstrated that the movements and operations of the propeller, starting, stopping, slowing, &c., can be controlled in less time than is possible with a steam engine. A hand-wheel on the controlling switch gear is the propeller control.

The Stephan Burglar and Fire Alarm.—This novel protective system, which was demonstrated recently in the presence of representatives of Scotland Yard, the London Fire Brigade and Salvage Corps, insurance companies, &c., is "founded upon the effects of resistance and capacity which are unconsciously produced by a person coming within the blanket of static electricity" that surrounds the object to be protected—so it is explained. During the demonstration the device was caused to function as a fire alarm by an increase in the temperature of the air adjacent to the protected object. As a burglar alarm it functioned on the approach of the demonstrator to within a few inches of the protected object and before he had time to actually touch it. The sensibility of the system is apparently augmented by the use of a Siemens thermionic valve amplifier, and its operation is not interfered with in any way should the burglar attempt to insulate himself; the alarm is not actuated by vibration, and it is hardly necessary to mention that the new system re-acts also on any attempt to destroy wiring, apparatus, or the case containing the latter.

The apparatus is held compactly in a case approximately 2 ft. 3 in. high, 10 in. wide, and 5 in. deep, and can be placed either in the room itself which is to be protected, or at any distance from the rooms or objects to be protected. If larger areas are to be protected, the contrivance can be centralised and the endangered locality reported to a central station by acoustic and optical signals. If the case is placed in the room which is to be protected, an intermediate or time switch permits the person occupying the room to leave it without releasing the alarm.

The connection between the apparatus and the rooms or objects to be protected consists of a thin lead-covered cable, which can easily be attached to or embedded in the wall and whose intentional or accidental destruction releases the alarm at once. It is possible to protect easily accessible and isolated objects of any kind, no matter whether they are made of metal, china, wood, fabric, or other material. The device is in the hands of Messrs. J. G. and R. B. Wainwright, Ltd., of London.

Service Note.—The introduction into the Navy of "director firing," of which Sir Percy Scott was the inventor, has given birth to a new training course. In order that "director layers" shall be conversant with the electrical aspects of the instruments they are required to use and to help maintain, and appreciate more thoroughly the necessity for careful handling, they are to undergo a five-days' course in low-power electricity in the torpedo schoolship *Vernon* on completing the existing qualifying course for director layers, says *The Times*.

The Old Brigade.—It is proposed to hold a dinner at the Hotel Cecil on January 20th for "Municipal Electrical Old Stagers," *i.e.*, those who served as chief engineers, or as assistants, subsequently becoming "chiefs," of municipal undertakings before December 31st, 1900. A number of distinguished "electrical" gentlemen have been invited. Tickets, 25s. each, inclusive of wine, may be obtained from the Secretary to the Committee which has been formed—Mr. C. H. Wordingham, C.B.E.

"Trade Follows the Telegraph."—The fact that news of the Irish settlement reached Australia within 14 minutes of its dispatch from London was related by Mr. John Lee, controller of the London Central Telegraph Office, in an address to the Birmingham Business Club recently, entitled "International Telegraphy in its Relation to Commerce." One million communications a month, he stated, passed to and from England over Government-owned lines and cables, of which 525,000 represented the incoming traffic. It might be taken that it was the purchaser or the intending purchaser who sent the telegrams, and as the incoming traffic increased, sooner or later, it would mean trade would increase also. "There is a popular superstition," said Mr. Lee, "that trade follows the flag. Don't you believe it! Trade follows the telegraph."—*Birmingham Post and Telegraph*.

Engineering in France in the Vacation.—We are informed that certain French engineering firms of the Lorraine district (rolling stock, railway material, &c.) have kindly consented to accept for periods of two or three months a few British engineering students during their summer holidays; applications, in writing, stating age and qualifications, and giving references, will be received (until further notice) by the Hon. Sec., British Section of Société des Ingénieurs Civils de France, 45, Great Marlborough Street, London, W.1.

The students will not receive any salary, and will make their own arrangements for the journey, board and lodgings. Local members of the Société will give advice in these matters if desired. The students, in their own interest, will undertake to submit to the same discipline and working hours as their French colleagues on the works' staff. Some knowledge of the French language is advisable.

Electrolytic Zinc Co. of Australasia.—An official cable states that the first unit of the main plant at Risdon, Tasmania, of the Electrolytic Zinc Co. of Australasia, which will absorb 15,000 h.p., started running on November 22nd. "Everything is running satisfactorily and in a few weeks it is expected the full output of this unit will be reached." It is added that "the complete plant, absorbing 30,000 h.p., will, it is expected, be running well before the end of 1922 with an output of from 40,000 to 45,000 tons of refined zinc per annum." The Electrolytic Zinc Co. of Australasia was formed in October, 1920, with a capital of £3,000,000, half in cumulative preference and half in ordinary shares, to acquire and extend a zinc ore treatment works at Risdon, Tasmania. Large participations were taken by the Amalgamated Zinc, North and South Broken Hill Companies and the Zinc Corporation; the shareholders in these and other Australian mining enterprises were invited to subscribe for shares.—*Financial Times*.

The Electro-Harmonic Society.—The veto placed on the too-early booking of seats seems to have had little or no effect upon members' attendance; the Great Hall of the Cannon Street Hotel was crowded on Friday evening last. Sir James Devonshire, K.B.E., occupied the chair, and a very good programme was "put on." Every item was well received, the programme including pianoforte *soli* by Mr. Bernard Flanders, A.R.A.M.; songs by Miss Winifred Kennard and Messrs. Barrington Hooper and Harry Dearth, and humorous and other items by Messrs. W. V. Robinson, Bernard Turner, Wilson James, and Harry Davson.

It does not appear that the attendance at the concerts during the first half of the session has been affected by the alteration which the committee recently found it necessary to make in the subscription. As we stated a month or two ago, resignations were foreseen as a result of the increase, but we understand that in actual fact they have been very few in comparison with the number expected, while the number of new members elected has been very gratifying. We think it only right to state the real position, because those who are under a misapprehension themselves and are not disinclined to circulate their wrong impressions among other people, may be brought to see that the change which the committee regarded as essential in the best interests of the whole society has been fully justified. That the audience on Friday last found the programme prepared for them very much to their taste was evidenced by the fact that every item from beginning to end was enthusiastically encored.

The Batti-Wallahs.—The efforts made to get members of the Batti-Wallahs' Society to take a greater interest in that body would seem to have failed, for a circular announces that owing to the small attendances at recent functions the committee on the 2nd inst. decided to abandon all meetings fixed for the future, excepting the annual dinner and the summer meeting. Mr. F. Pooley, the hon. sec., and Mr. A. J. Greenly, the hon. entertainment secretary, are resigning at the next annual meeting.

INSTITUTION NOTES.

Institution of Electrical Engineers.—An extraordinary meeting of the Institution will be held on January 12th, 1922, when three sets of kinetmatograph pictures will be exhibited on the screen, accompanied by explanatory notes.

LIVERPOOL SUB-CENTRE.—Mr. J. S. Highfield, the president, addressed the members of the Sub-Centre on December 12th. He outlined the advantages gained by the Institution for its members by the grant of the Royal Charter, and pointed out the great use that Centres and Sub-Centres could be in guiding the Council. Dr. S. P. Smith followed the president, and gave his lecture on "Single- and Three-phase Commutator Motors with Shunt and Series Characteristics." The lecture was well illustrated by lantern slides. Mr. Teago opened the discussion and dwelt on the main points brought out by the lecturer, and added a few remarks outlining some research work carried out by him under the direction of Dr. Marchant at the Laboratories of Applied Electricity, The University, Liverpool, on a motor of similar characteristics. Messrs. Peck, Dawbarn, Young, Malpas, Rettie, Clothier, Abernethy, and Ashby also took part in the discussion. After the meeting experiments were carried out in the laboratories on the motor referred to.

SCOTTISH CENTRE.—Mr. H. Martin delivered an abstract of the paper on "Cyc-Arc" automatic welding before the Scottish Centre at Glasgow on December 13th. The lecture was fully illustrated by lantern slides. Many examples of welded specimens were exhibited, and a demonstration of welding was given which showed the various operations, but the results obtained were not satisfactory because the supply voltage was rather low. It is interesting to note that the supply was taken from the battery of an electric vehicle.

Physical Society of London.—The twelfth annual exhibition of electrical, optical, and other physical apparatus will be held as usual on January 5th and 6th, 1922, at the Imperial College of Science, South Kensington. Tickets of admission are obtainable from the secretaries of the Physical and Optical Societies and the Institution of Electrical Engineers.

Institution of Production Engineers.—A general meeting of the Institution will be held on December 30th at the Institution of Mechanical Engineers. Mr. G. H. Hales (member of Council), works manager of Messrs. Drummond Bros., Ltd., Guildford, will deliver a paper, to be illustrated by lantern slides, dealing with "The Costing System and its Relation to Production." Advance copies of the paper will be available a few days before the meeting, and may be obtained on application to the hon. secretary.

Chelmsford Engineering Society.—On December 8th Mr. D. Spencer, of Messrs. Armstrong, Whitworth & Co., Ltd., read a paper on "Hydro-electric Opportunities," Mr. G. F. Barrett, O.B.E., the president, being in the chair. The lecturer explained that although only a small amount of water power had been developed in the British Isles, there was a large quantity, estimated at 900,000 h.p., available. An abundant and cheap supply of electric power might easily be provided in countries such as India and Australia with hydro-electric equipment. The lecturer held the view that in a few years' time India and Australia would become great manufacturing countries, and that the latter would manufacture woollen goods instead of sending the raw wool to this country. Invariably hydro-electric schemes necessitated a long transmission line, but the present tendency was to use much higher pressures than hitherto. Mr. Batalliard described the Francis turbine and the Pelton wheel. He dealt with various points in the design and construction of turbines and their application.

Faraday Society.—At the annual general meeting of the society held on December 13th the following officers were elected:—President, Professor Alfred W. Porter, F.R.S.; Vice-presidents, Mr. W. R. Cooper, Dr. J. A. Harker, F.R.S., Prof. C. H. Desch, Mr. E. Hatschek, Prof. F. G. Donnan, C.B.E., F.R.S., Prof. T. M. Lowry, C.B.E., F.R.S., and Dr. G. Senter; Treasurer, Mr. Robert L. Mond. The annual report stated that the work of the society had greatly expanded, and an appeal was made for an increased membership without which it would be difficult for the society to keep pace with its increasing activities without a higher subscription.

Glasgow and District Radio Club.—At a meeting of the club that was held on October 12th the president gave Part 1 of his lecture on "The Theory of the Thermionic Valve." Mr. Snodgrass dealt with the emission of electrons from heated bodies and, with the aid of diagrams on the blackboard, explained the working of a valve up to the point where it begins to oscillate. At the meeting on October 25th Mr. Snodgrass favoured the members with Part 2 of his lecture. November 9th was an "open" night, and after the conclusion of routine business the secretary read a letter from the Wireless Society of London with reference to arrangements which are being made between the Marconi Co. and the G.P.O. authorities regarding proposed special weekly transmissions for the benefit of amateurs. Mr. Wm. R. Clark discoursed on the "Electronic Theory of Electricity" on November 23rd. Some receiving apparatus is being rejuvenated by a sub-committee, and will be in use shortly. In this connection the club is highly indebted to the following members for gifts of accessories:—Messrs. W. Yuill, W. K. Dewar, D. C. Wright, D. B. McQuistan, A. Pick, J. T. McDade, and E. Snodgrass. "Buzzer" practice is now available each meeting night between 7.30 and 8 p.m. for members.

Institute of Transport.—Mr. James Paterson, a director of Messrs. Carter, Paterson & Co., Ltd., lectured, under the auspices of the above-named Institute, at the Royal Society of Arts, on December 16th, on "The Operation of a Road Distributing Agency," remarking that the field for the electric vehicle was widening rapidly both at the expense of horse-drawn and the petrol-driven vehicle. In his opinion, the field of usefulness of that type of car would eventually be very much greater, especially for door-to-door delivery purposes.—*Financial News.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The Times reports that Sir JAMES KEMNAL was received on Tuesday last week by the King of Spain, who complimented him on the rapid completion of the Spanish Babcock & Wilcox works at Bilbao.

Councillor W. CHILTON has been appointed chairman of the St. Pancras Borough Council Electricity and Public Lighting Committee for the ensuing year.

Mr. GEORGE STEPHEN HERSCHELL, senior superintendent of the Edinburgh Telegraph Department, has retired after serving in the Post Office for 47 years. At a meeting presided over by Major Jayne, Controller of Telegraphs, Mr. and Mrs. Herschell were presented with gifts from the staff.

Mr. Alderman ATTLEE has been appointed chairman and Mr. Councillor LAZARUS vice-chairman of the Stepney Borough Council Electricity Committee.

NEW COMPANIES REGISTERED.

Blockley Electrical Engineering Co., Ltd. (178,315).—Private company. Registered December 10th. Capital, £1,000 in £1 shares. To carry on the business indicated by the title. The first directors are: A. E. Beck, Dovedale, Blockley, Worcs.; L. A. Beck, Dovedale, Blockley, Worcs. Qualification: Ten shares. Registered office: The Electricity Works, Blockley, Worcs.

Lawford Ross, Ltd. (11,968).—Private company. Registered in Edinburgh December 10th. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The first directors are: A. D. O'Hara, 45, Woodlands Road, Glasgow, produce merchant; W. G. Williams, 3, India Street, Charing Cross, Glasgow, manufacturer; W. Kerr, Grand Hotel, Charing Cross, Glasgow, restaurateur; P. J. Neeson, 39, Camphill Avenue, Langside, Glasgow, wine and spirit merchant; R. L. Ross, 35, Lawrence Street, Dowanhill, Glasgow, electrical engineer. Qualification: £50. Secretary: R. M. Broadfoot. Registered office: 170, Hope Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £1,150 on December 6th, 1921, of trust deed dated June 28th, 1905, and deed of acknowledgment dated June 12th, 1907, securing £200,000.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Particulars of £17,500 prior lien debentures authorised December 6th, 1921. Whole amount issued. Charged on company's undertaking and property, present and future.

Chipperfield, Ltd.—Second mortgage debenture, dated December 1st, 1921, to secure £50. Charged on certain premises in Bridge Road, Oulton Broad, Suffolk. Holder: S. Bailey, 150, London Road North, Lowestoft.

Saitax Manufacturing Co., Ltd.—Debenture, dated November 30th, 1921, to secure £2,525. Charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. H. Palmer, "Wilton Arms," High Street, Thornton Heath.

City of Oxford Motor Services, Ltd. (formerly City of Oxford Electric Tramways, Ltd.).—Satisfaction to the extent of £1,500 on November 24th, 1921, of charge dated February 20th, 1914, securing £46,000.

Electric Welding Co., Ltd. (31,364).—Return dated November 8th, 1921. Capital, £460,000 in £10 shares 45,000 ordinary and 1,000 founders'). 22,417 ordinary and 917 founders' shares taken up. £10 per share called up on 14,084 ordinary and 917 founders. £143,665 7s. 6d. paid, including £6,835 4s. 11d. paid on 2,583 ordinary and 36 founders' shares forfeited. Calls in arrears amount to £13,179 17s. 5d. £83,330 is considered as paid on 8,333 ordinary shares. Mortgages and charges, £22,400.

Pacific & European Telegraph Co., Ltd. (36,683).—Return dated November 15th, 1921. Capital, £100,000 in £10 shares. All shares taken up. £40,000 paid, being £4 per share. Mortgages and charges, £66,800.

United Electric Tramways Co. of Caracas, Ltd. (89,642).—Return dated November 29th, 1921. Capital, £200,000 in £1 shares. 170,000 shares taken up. £7 paid. £169,993 considered as paid. Mortgages and charges, £145,800.

Thos. W. Ward, Ltd. (81,020).—Return dated October 13th, 1921. Capital, £1,100,000 in £1 shares (150,000 first preference, 250,000 second preference, 600,000 ordinary, and 100,009 employés). All the first and second preference and ordinary and 25,491 employés' shares taken up. £621,528 paid. £403,963 considered as paid. Mortgages and charges, nil.

Electric Supply Corporation, Ltd. (52,036).—Capital, £250,000 in £5 shares. Return dated July 28th, 1921. 42,000 shares taken up. £175,000 paid on 35,000. £35,000 considered as paid on 7,000. Mortgages and charges, £154,914.

Fors Accumulator Foreign Patents, Ltd. (108,151).—Capital, £3,000 in 952 preference and 2,048 ordinary shares of £1 each. Return dated January 11th, 1921 (ried July 22nd). 584 preference and 2,048 ordinary shares taken up. £132 paid on 132 preference. £2,500 considered as paid on 452 preference and 2,048 ordinary. Mortgage and charges, £125.

CITY NOTES.

The Tata Companies.

The *Times of India* reports that the annual meetings of the shareholders of the Tata Power Co., Ltd., the Tata Hydro-Electric Power Supply Co., Ltd., and the Andhra Valley Power Supply Co., Ltd., were held in Bombay on November 25th.

The report of the first-named company for the year ended June 30th last stated that the Government's consent had been obtained to the acquisition of lands and to the supply of electricity. Demands for power aggregating 60,000 h.p. had been received from factories, mills, &c., and Mr. F. W. Willis, the general manager of the other two companies, had been appointed to a similar position in the Tata Power Co. The route of the Roha-Bhira Railway has been constructed, and it was expected to have the 23 miles of track laid by the end of the present year. The laying of the lines between Chinchwad and Mulshi was practically completed before the monsoon; the heavy rains had necessitated a great deal of repair work on both railways. As a result of native agitation against the flooding of the site of the dam, the company agreed not to commence this before November, but the erection of staff quarters had been proceeded with in the meantime. A great deal of survey work had been carried out, and the site for the power house had been selected. During the year all the transmission line towers between Panvel and Bhira were erected, with a few exceptions, and the telephone line connecting Roha with Kolad was completed. A sub-station was erected at Panvel to tap the Hydro-Electric Co.'s main, from which power would be taken to the sites of the tunnel and dam. Copper cable and insulators had been received for the single circuit between Panvel and Bhira, and orders for the second circuit had also been placed on favourable terms. The chairman, in moving the adoption of the report, said that the taking of power from the Hydro-Electric Co. for the constructional work at the dam, tunnel, and power house sites would obviate the costly transport of fuel, and the line being used for the purpose would form part of the main transmission line to Bombay. Upon the whole the year's progress had been satisfactory, with the exception of work on the Mulshi hydraulic division, which had been retarded by the action of native agitators, who had circulated false statements regarding the eviction of landowners from the area which was to form the dam. The company had decided to stop work on the hydraulic part of the scheme in the hope that the owners would realise what was in their true interests. They had, however, successfully excavated the whole of the foundations of the dam and had found rock of good quality upon which the dam could safely be raised. A resolution was passed sanctioning the payment of interest out of capital on ordinary and preference shares for the year ended June 30th at the rate of 4 per cent. The retiring directors were re-elected. During the meeting a statement was distributed by the organisers of the agitation against eviction, announcing their intention of continuing their "satyagraha" or campaign, from the terms of which it appeared that the principal objection was to the influx of foreign, *i.e.*, British, capital and "Western industrialism."

The report of the directors of the Tata Hydro-Electric Supply Co., Ltd., recorded a total income of Rs. 36,15,110. Deducting working expenses, Rs. 16,96,131, and depreciation, Rs. 3,00,000, the gross balance was Rs. 16,18,979. The addition of Rs. 87,956 brought forward brought the total disposable profits to Rs. 17,06,935. An interim dividend at the rate of 7 per cent. per annum for the half-year ended December 31st, 1920, absorbed Rs. 8,33,960. The directors recommended the payment of a final dividend at the rate of 7 per cent. per annum, less income tax, on preference shares and 7 per cent. on ordinary shares. This would absorb Rs. 8,57,570, leaving a balance of Rs. 15,405 to carry forward to the next account. Although working hours had been reduced from 12 to 10 per day, revenue had increased owing to some mills working extra hours and also to the completion of the second installation. Forty-six consumers were now taking power aggregating 45,000 h.p. Owing to the joint agency and management of the Hydro-Electric Co. and the Andhra Valley Co., arrangements had been made to interconnect the systems to ensure a more certain continuity of supply. This linking-up had been achieved by aerial tie lines between the respective generating stations at Khapoli and Bhivpuri and the receiving stations at Parel and Dharavi. The extensions necessitated by the inter-connection were practically completed by the end of the year. The working of the power station and cables had been satisfactory. The total rainfall during the season amounted to 139 in., and the amount of water stored in the lakes was sufficient to meet the company's requirements up to the end of the next monsoon. In presenting the report, the Chairman (Mr. R. D. Tata) said that the company had hopes of an increased load in the near future; the local Tramways Company had been negotiating to take the whole of its power requirements from the Hydro-Electric Co. and its sister companies as early as possible. The dividend of 7 per cent. was approved and the report and accounts adopted.

The directors of the Andhra Valley Power Supply Co. reported that landowners whose land had been acquired up to date had been satisfied with the compensation paid them. The whole of the company's available power had been disposed of. About 30 consumers, chiefly textile mill owners, had contracted to take power from the company for a period of ten years at the rate of .725 anna per kWh, the consumers installing their own electrical equipment. The general manager reported that progress in the construction works had been good. Out of a total of seven million cu. ft. of masonry, 5.7 million cu. ft. had now been laid. The dam was now 138 ft. high; its finished height would be 190 ft. The masonry work on the auxiliary dam and the excavation of the tunnel had been completed, as had also practically all the important building work. All the generators had been erected, and two of these would be ready for service early in the New Year. Nearly all the transmission-line towers were in position, and the erection of one line was practically finished. Other plant installed included three banks of transformers and two 12,000-kW synchronous condensers. Good progress had been made in the installation of switchgear at mills and distributors had been laid to the supply points. In his speech the Chairman said that the first part of the system was complete and two pipe lines had been laid. It was expected that in 1923 all six pipe lines would have been installed and the whole of the Andhra system would be in commission. The connecting-up of all their consumers would occupy about two years, at the end of which the company would be in a position to commence the payment of dividends. The payment of interest out of capital during construction, at the rate of 4 per cent. per annum on preference and ordinary shares, was sanctioned.

Vickers, Limited, Sheffield.

The directors, in reporting for the year ending December 31st, 1920, state that the discussions with Government Departments concerning the prices of certain contracts executed during the war, and concerning taxation, have caused delay in the presentation of the accounts, and are still continuing. In order to present the accounts for the annual meeting, it has been necessary to make estimates where no definite results have been achieved, and these estimates have been formed on conservative lines. All the company's works in the year 1920 were very seriously affected by labour disturbances inside and outside, and particularly by the prolonged moulders' strike, which threw all engineering and shipbuilding production out of balance. The company's electrical interests were fortunately less affected than the other branches. High prices of coal and of raw material, heavy taxation, and the disordered condition of foreign exchanges accentuated the un-

favourable circumstances, and the company, in common with others, suffered much from these adverse influences. Customers, under such conditions and in the hope of a future fall in prices, would naturally only effect purchases when forced by the necessity of their own requirements to do so, and trade was thus reduced to very narrow limits. Moreover, the large proportion of the company's works, kept at the disposal of the Government for the production of armaments, was practically empty of work, a fact which necessarily added to the difficulties which the company has had to face. The fall in value of all stocks and materials towards the end of the year caused losses which have been provided for in the accounts. In order to provide, without encroaching too much upon the company's cash resources, the requisite means for the change over from war to peace work, and for the extension of the company's electrical interests, the board authorised the creation of £4,000,000 7 per cent. seven-year notes. Of these £1,500,000 were issued in July, 1920. The issue expenses have been written off from the "premiums on shares reserve account." The profit as shown by the accounts is £541,261, out of which preference dividends have been paid for 1920 amounting to £395,985, leaving a balance of £145,275, which has been added to the "carry forward" from December 31st, 1919, of £846,364, leaving at credit of "profit and loss account" £991,639. In view of the necessity of conserving the company's resources in the present state of trade, the directors do not recommend the declaration of any dividend for the year 1920 on the ordinary shares.

C. A. Vandervell and Co., Ltd.

In their report for the year ending March 31st, 1921, to which we made brief reference last week, the directors express their regret that the result of the year's trading has shown a very considerable loss. This was caused by the sudden national trade depression which affected every industry in the country during the latter part of 1920 and at a time when the company had large contracts on hand for electrical equipment (the majority of which had to be cancelled), and had correspondingly placed large orders for material to meet customers' requirements. Thus heavy stocks were acquired at prices which had depreciated enormously by March, 1921, and which have been valued in the balance sheet now presented at the prices prevailing on March 31st, 1921. The programme of the company's works' production being at this period organised for an exceedingly large output, it was impossible immediately the cessation of orders occurred to retrench sufficiently at once to save the inevitable disproportion between establishment charges and productive labour, which has so militated against the company's trading during the year under review. Steps, however, were taken as soon as possible which have rectified this situation. The questions of the Excess Profits Tax, and allowances by the Government on the war plant and buildings, are not yet settled, but it is anticipated they will be cleared up satisfactorily to the company at an early date. In dealing with the accounts, the directors have withdrawn the £75,000 which was placed to reserve last year, and have also absorbed the £140,499 brought forward from the previous year, to meet the deficiency in this year's accounts.

The loss as per balance sheet is £251,472. The amount brought forward was £140,499, less dividends paid, £22,500, making £117,999, so that the balance of loss is £133,282, which will be reduced by £75,000 transferred from reserve account, after confirmation by the shareholders, leaving £58,282 to be carried forward.

Cape Electric Tramways, Ltd.

The annual meeting of shareholders was held in London on December 14th. Mr. Ludwig Breitmeyer (chairman), presiding, said the introduction of new rolling stock during the year had resulted in the more advantageous dealing with the heavy traffic in Cape Town, while ensuring more comfort for the passengers. On both the Cape Town and Port Elizabeth systems there had been an increase in the number of passengers carried, the total increase being 3,851,958. The previous year's figures were, however, low on account of the strike, and the true increase was about 1,800,000. The ratio of working expenses to income was only about 1½ per cent. higher than in the preceding year and, having regard to the downward trend of material and labour costs, the position was bound to improve as time went on. Both systems had been carried on without interruption during the year under review. The Cape Town municipality had decided not to exercise its option of purchase, but although the company was now secure until 1925, it could not undertake any extensive additions to the system owing to the feeling of uncertainty as to the municipality's decision when the question of acquisition again arose, unless an adequate return was assured and the recoupment of the expenditure was guaranteed.

French Companies.

The *Compagnie Industrielle des Téléphones* has declared a dividend at the rate of 40 francs per share for 1920-21, or 5 francs more than in the preceding year.

The *Société d'Electro-Metallurgie de Dives* reports net profits and balance forward amounting to 6,676,000 francs for 1920-21, permitting of the payment of a dividend at the gross rate of 60 francs per share.

The *Société des Porcelaines et Appareillages Electriques Grammont*, owing to the growth in general expenses and the depreciation of stocks, reports a loss of 765,000 francs for 1920-21, which has been carried forward.

The gross profits of the *Compagnie Générale d'Electricité*, of Paris, in 1920-21, are reported at 12,021,000 francs, as compared with 11,263,000 francs in the previous year, the net profits being 7,223,000 francs and 7,370,000 francs in the two years respectively. The dividend is at the rate of 60 francs per share as in 1919-20.

Société Paris-Rhône.—The meeting of this company on November 5th passed the accounts of the preceding year. The profits amounted to 876,679 francs after payment of the statutory dividend of 6 per cent. on the capital, which absorbed 360,000 francs. The balance was allotted to the sinking funds of works under way and stocks in store, the Council having been led to take this step by the reductions which had occurred in the cost of prime materials during the financial year. Issue had been made during the course of this year of the 1,200 500-franc bonds authorised by the last meeting.

The following French electrical companies have increased or propose to increase their capital:—The Compagnie Electrique de la Grosne (Chalms-sur-Saône) up to 1,500,000 fr.; Tramways Electrique de Belfort, issue of 2,030,000 fr.; Société Electrique de Samois-sur-Seine, issue of 200,000 100-fr. 6 per cent. shares; and Société de Purification Industrielle des Gaz (electric precipitation), from 220,000 to 440,000 fr.

Claud Hamilton, Ltd.—At the annual meeting on December 12th Mr. A. J. Fergusson, who presided, said that the directors did not recommend the payment of a dividend this year, although the result of the trading for the year was one of the best in the history of the undertaking. They did this in order to consolidate the financial position, as there was a considerable bank overdraft to reduce. They were capitalising a portion of the general reserve fund and distributing an amount among the ordinary shareholders as fully-paid bonus shares in the proportion of one for every ten shares held. At an extraordinary general meeting which followed, the increase of capital by 10,000 ordinary shares of £1 each was agreed to, and the Articles were altered to permit of the payment of bonus shares.

Power-Gas Corporation, Ltd.—At the annual meeting, held on December 13th, the chairman (Mr. E. Lloyd Pease) said that the dearth of capital, high costs, and uncertainty as to the future were detrimental to the investment of money in industrial plant and machinery, but nevertheless the year's result was comparatively favourable. He protested against the excessive cost of the carriage of goods and the burden of municipal rates. During the year the company had purchased the patent rights of Continental water-gas plant and was now ready to commence manufacture.

Stock Exchange Notices.—Dealings in the following Securities have been specially allowed by the Stock Exchange Committee under Rule 148a:—

Llanelly and District Electric Lighting and Traction.—£125,000 seven-and-a-half per cent. debenture stock, issued at 94 per cent., partly and fully paid.

Reading Electric Supply.—£100,000 seven-and-a-half per cent. first mortgage debenture stock, issued at 95 per cent., partly and fully paid.

Newcastle-upon-Tyne Electric Supply, Ltd.—£750,000 6 per cent. second mortgage debenture stock, issued at 85½ per cent., partly and fully paid.

German Companies.—The Brown, Boveri Co., of Mannheim, is increasing its capital to 175,000,000 marks by the issue of 60,000,000 marks in new ordinary shares.

The Berliner Telephonfabrik Gesellschaft, of Hanover, is declaring a dividend of 20 per cent. for the last financial year, as compared with only 15 per cent. in the preceding twelve months.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income tax on the preference stock, for the quarter ending December 31st, 1921, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock free of income tax in respect of profits for the year ending December 31st, 1921, are announced.

Marconi's Wireless Telegraph Co., Ltd.—Dividend of 7 per cent., less income tax, upon the 250,000 7 per cent. cumulative participating preference shares; interim dividend of 5 per cent., less income tax, upon the 2,636,906 ordinary shares.

Victoria Falls & Transvaal Power Co., Ltd.—Dividend at the rate of 6 per cent. per annum less tax on the preference shares for the past half-year.

Manila Electric Corporation.—A dividend of 1½ per cent. for the past quarter on the common stock is to be paid. The company has changed its name from the Manila Electric Railroad and Lighting Corporation to the above.

Automatic Telephone Manufacturing Co., Ltd.—Dividend on the 6 per cent. preference shares for the half-year ending December.

Chile Telephone Co., Ltd.—Interim dividend of 3s. per share, free of tax, for the half year ended September.

Burmah Electric Tramways & Lighting Co.—There is put to general reserve and depreciation £5,000; £1,909 is required for Corporation tax, and a dividend of 8 per cent. is paid on the preference shares for the period ended September, 1915, leaving, says the *Financial Times*, £545 to carry forward.

STOCKS AND SHARES.

Monday Evening.

The imminence of the Christmas holiday season has made no difference to the strength shown by the investment markets of the Stock Exchange. Nor has the great shopping carnival put any noticeable check upon the spending power of the investor, so far as Stock Exchange securities are concerned. One after another, new issues are snapped up avidly. The Llanelly & District 7½ per cent. debenture stock, offered at 94, is about ¼ discount; the Reading 7½ per cent. debenture stock which came out at 95, commands a small premium. The Newcastle Electric 6 per cent. second debenture stock offered at 85½ stands at 1¼ premium above the issue price. British Thomson-Houston debenture has come up from 92½ to nearly a couple of points higher. The same tendency is making itself felt in practically every sound security, and, by way of illustration, it may be mentioned that dealers in the market for Home Railway prior-charge stocks complain that they have no longer any decent-sized lines to offer, whereas a month ago their books were heavy with stock.

District 4½ per cent. first preference has risen to 60, and the Assented first preference (interest 3½ per cent.) guaranteed by the Underground Electric Railways Co., of London, advanced to 47½. Even East London debentures are moving, the second-charge "A" stock rising to 59, the "B" to 36¼, and the third debenture to 15½. Business has also been marked in the company's fourth debenture at 9. Central London Assented stocks, of alll three classes, have risen to the common level of 51½, while the non-assented stand at 35½, 40¼, and 32½ for ordinary, preferred, and deferred stocks respectively. Districts have lost a point of their previous, and rapid, rise.

The feature of the week, however, amongst Undergrounds, is the way in which the Income Bonds of the holding company have been run up, the price mounting to 77½, showing a gain of 4 following a rise of 6 which took place last week. The company's £10 shares, however, have lost an eighth. It is interesting to set out the companies controlled and operated by the combine, and we take the following figures from a private brochure issued by a firm of Stock Exchange brokers to their clients. This gives, in short compass, an excellent idea of the way in which the interests are held and spread:—

Company.	Total capital.	Underground Electric Co.'s holding.	Revenue for year ending Dec. 31,'20.
Metropolitan District	£13,687,824	£3,341,500	£47,250
London Electric	17,597,610	10,294,990	154,118
City and South London ...	3,423,829	1,872,360	38,385
Central London	4,556,000	Nil	Nil
London General Omnibus ...	3,487,357	1,600,480	114,320
London and Suburban Traction	3,903,374	896,310	Nil
Associated Equipment ...	1,600,000	1,100,000	208,571
Miscellaneous holdings ...	6,798,395	287,707	4,000
	£55,054,389	£19,393,347	£566,644

The Buenos Ayres Western Co., of the Argentine Republic, is raising fresh capital in the shape of 4 per cent. debenture stock in order to complete electrification work on the line at Buenos Ayres commenced some years ago. It was thought that this offer might prove the prelude of similar issues from the other Argentine Railway companies, but nothing further has been heard on this point. Meanwhile, the case for further extension of electrification by the steam companies is being strongly urged by those who look to a great revival of railway enterprise now that the companies have got back to something like their own footing of control, though it has to be remembered that, in certain respects, the Government retains a grip upon the railways.

The market for home electricity shares is very steady, showing, however, no particular feature on the week. It is by no means easy to buy shares in this department, and those which come in are rapidily absorbed by the regular investor. Bromptons are ½ higher. The new issues are decidedly firm. Lancashire Electric Light & Power 7½ per cent. debentures, which came out at 95, have gone up to 102. County of London Electric 7 per cent. debenture is 10¾ premium. In some of the stocks the dealers will quote only prices at which they are prepared to buy. Electric manufacturing shares are quiet. Siemens have been a good market at 21s. 6d. General Electrics hardened to 18s. 3d.

The interim dividend on Marconis has just been declared and is 5 per cent., the same as that of a year ago. In consequence, the price hardened a little to 1¼, while Marines remain firm at a guinea. Anglo-American Telegraph deferred has risen to 18½, owing to the fact of the dividend impending. In the Eastern group, nothing of fresh consequence has developed. Prices maintain the slightly better tendency discernible last week. Westerns and both kinds of Globe shares are ex-dividend, recording most of the deduction in each case. Great Northerns at 25½ are the fraction higher.

Conditions in Brazil are declared to be getting into a more cheerful state, and many of the railway and traction stocks have advanced during the past few days. Brazilian Traction common gained a couple of dollars. On the other hand, Rio Tramways and other bonds, which are affected by the rise or fall in the dollar, have come down substantially as the result, of course, of the manner in which the £ sterling has gone up in relation to the dollar. This does not touch Mexicans in any way, but the market in these is quiet again, interest having dwindled to a minimum.

Rubber shares remain out of the picture as regards public interest. The price of the produce scarcely moves from day to day. By the time these notes are published, it may be that further testimony will have been provided of the difficulties that beset the rubber-producing industry in any attempt to get varying interests to work co-operatively. Vickers went up on the issue of what can only be described as a poor report to the end of 1920, although the company, like all others of its kind, has naturally been faced with peculiar obstacles in changing-over from war to peace work. Nevertheless, the general markets of the Stock Exchange show sufficient strength to warrant the assumption, as well as the wish, that the recent recovery will help not a little in assisting the pleasures of a Merry Christmas.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1919.	Dividend. 1920.	Price Dec. 19, 1921.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	6½	+ ½	£9 4 8
Charing Cross Ordinary	7	8	4½	—	8 17 10
do. do. do. 4½ Pref.	4½	4½	3½	—	7 4 4
Chelsea	4	6	3½	—	9 4 8
City of London	13	14	1⅞	—	9 14 10
do. do. 6 per cent. Pref.	6	6	18/-	—	6 13 4
County of London	8	8	8½	—	9 2 10
do. do. 5 per cent. Pref.	6	6	7½	—	7 10 0
Kensington Ordinary	7	9	5	—	9 0 0
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	8½	+ ½	9 12 0
Metropolitan	6	7	8⅝	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2½	—	7 18 2
St. James' and Pall Mall	12	12	6½	—	8 17 10
South London	6	7	2⅝	—	10 18 2
South Metropolitan Pref.	7	7	17/6	—	8 0 0
Westminster Ordinary	16	10	5½	—	8 10 2
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	84	+1	7 2 10
do. Def.	1½	1½	18½	+ ½	8 2 2
Chile Telephone	6	6	5½	—	5 17 8
Cuba Sub. Ord.	7	7	7	—	10 0 0
Eastern Extension	10	10	16⅜	—	6 2 2
Eastern Tel. Ord.	10	10	163½	—	6 2 4
Globe Tel. and T. Ord.	10	10	16½xd	+ ½	6 3 1
do. do. Pref.	6	6	94xd	+ ½	6 9 9
Great Northern Tel.	22	24	25½	+ ½	9 8 2
Indo-European	10	10	27½	—	9 2 0
Marconi	25	15	1⅜	+ ⅛	8 11 6
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	5½	—	*7 0 8
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	16½xd	+ ½	*6 3 1
Home Rails.					
Central London Ord. Assented	4	4	51½	+2	7 15 4
Metropolitan	1½	1½	25½	—	5 17 8
do. District	Nil	Nil	21	—1	Nil
Underground Electric Ordinary	Nil	Nil	2	— ½	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	2	77½	+4	*3 18 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	98	—	10 9 6
do. do. 2nd Pref.	Nil	5½	9½	—	8 0 0
do. do. 5 per cent. Deb.	5	5	63½	—	7 17 6
Brazil Tractions	Nil	Nil	33	+2	Nil
British Columbia Elec. Rly. Pfce.	5	5	58	—	8 12 4
do. do. Preferred	5	20/-	51	—	*9 5 0
do. do. Deferred	3	12½/-	57½	—	*10 17 8
do. do. Deb.	4½	4½	61½	—	6 18 3
Mexico Trams. 5 per cent. Bonds	Nil	Nil	55½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	97½	—	Nil
Mexican Light Common	Nil	Nil	18	—	Nil
do. Pref.	Nil	Nil	27	—	Nil
do. 1st Bonds	Nil	5	61½	—	8 2 8
Manufacturing Companies.					
Babcock & Wilcox	15	15	9⅜	—	6 14 9
British Aluminium Ord.	10	10	14/6	—	—
British Insulated Ord.	15	15	14	—	10 14 2
Callenders	15	15	14	—	10 18 2
,, 6½ Pref.	6½	6½	18/9	—	6 16 8
Crompton Ord.	10	10	13/9	—	14 11 0
Edison-Swan	10	—	6/-	—	—
do. do. 5 per cent. Deb.	5	5	64	—	7 16 3
Electric Construction	10	10	18/3	+9d.	10 19 2
English Electric	8	8	10/-	—	16 0 0
do. Pref.	6	6	12/6	—	9 12 0
Gen. Elec. Pref.	6½	6½	17/-	—	7 13 0
do. Ord.	10	10	18/3	+9d.	10 19 2
Henley	15	15	29/3	—	10 5 7
do. 4½ Pref.	4½	4½	8⅜	—	6 4 2
India-Rubber	10	—	⅞	—	—
Met.-Vickers Pref.	8	8	14	—	9 2 10
Siemens Ord.	10	10	1⅞	—	*2 5 2
Telegraph Con.	20	20	21½	—	*5 11 9

* Dividends paid free of Income Tax.

SHIP LIGHTING—IN RELATION TO SAFETY, COMFORT AND EFFICIENCY.

By W. J. JONES.

(Abstract of paper read before the Illuminating Engineering Society.)

Certain general considerations with regard to ship-lighting are evident. Of paramount importance is reliability in the lighting, on which the safety of the ship depends. Again, there are special requirements in the form of weather-proof wiring and fittings; the arrangement of lights is limited by restricted overhead space and the fact that fixtures must be rigid and unaffected by the motion of the ship. Lighting problems naturally depend on the purpose served by the ship, *e.g.*, whether a warship, a liner, or a cargo vessel, but in all cases lighting under the deck is important by reason of the fact that the admission of daylight is restricted.

The question of providing artificial light on the deck itself is a more debatable one. To the landsman it would seem that work on the deck of a ship at night would be assisted by judicious lighting; shipmasters and officers, however, seem disinclined to use lights on decks of sailing ships, presumably on the ground that glare would prove distracting and even dangerous, and that the contrast between the lighted deck and the surrounding darkness would interfere with the look-out.

The wiring of ships is a matter of special importance in view of the fact that it is essential that the risk from fire from electrical defects be reduced to a minimum. The rules issued by the Institution of Electrical Engineers on ship lighting embody the most recent information and modern practice to ensure safety. One of the most important matters is to ensure that in passenger vessels there are spare generators to serve in case of breakdown. It may seem extravagant to split the generating plant up into a number of units, but the thermal efficiency of the small engines at full load is much greater than that of large ones that are under-run.

The main generators are usually capable of supplying the full normal requirements of the ship with one out of commission. This arrangement allows repairs or adjustments to be made and still preserve the continuity of the supply. It is usual to have an emergency plant, sometimes driven with an oil engine, placed well above the water line, for use in the event of the boiler room being flooded, or accumulators are installed on one of the upper decks to serve the same purpose.

Of the methods of distribution of electrical energy in the ship the ring method is coming more and more in favour, and in a modern liner the number of lamps called for often exceeds 10,000 or 12,000.

The electric lighting fittings must be of a strong and substantial design, and sufficiently rigid to withstand the motion of the vessel. On account, however, of the low head room that is available, they must necessarily be short. Fittings may be classified into three distinct types:—

1. Special ornamental or decorative fittings for first-class state rooms and saloons. These majolica fittings consist chiefly of a shell of cream porcelain which covers the lampholder. Frosted lamps are most frequently used in conjunction with these fittings. For state rooms berthlights are provided with Holophane bowls which focus the light to the position required (eliminating the possibility of disturbing the occupants of other berths with stray light).

2. Plain brackets and pendants for the passage ways and third-class rooms, in which utility is required rather than ornate appearance.

3. Watertight fittings, such as well-glass and bulkhead fittings, for the engine room, decks, and other exposed parts of the vessel.

For the purpose of steering, the Board of Trade specifies that there shall be navigation lights, and the visibility of such lights when seen at a distance is naturally of very great importance, and has been the subject of research at the National Physical Laboratory during recent years. The lamps for the masthead, stern light, and side lanterns are specified to consist of 32 c.p. carbon-filament lamps, having two filaments each of 16 c.p. operating in parallel; the reason being that should one filament fail it is a very remote chance that the other will go out of commission at the same time. It is important that the failure of any one of the lights should be immediately known, and some form of indicator is therefore necessary which will show by means of luminous indications when the lamps are burning satisfactorily, and also give an audible signal when they fail and a visual warning when one of the filaments of double-filament lamps breaks.

On the front of such an indicator is shown a deck plan of the ship in white enamel and having small circular windows in positions corresponding to those of the navigation lights. The glasses of the windows indicating the side lights are coloured red and green respectively, the windows indicating the masthead and stern lights being of white glass. The case contains switches which control the navigation lights. As long as the navigation lights are burning satisfactorily the windows of the indicator are illuminated from the inside by small indicating lamps, each window having its own lamp. The indicating lamps are not directly in series with the navigation lamps, but are connected in parallel with coils which are in circuit with the navigation lights; and failure of the indicating lamp, therefore, does not interrupt the circuit of the navigation lamp. The coils act as relays and control the circuit to a watertight bell mounted on the top of the case.

In the event of any of the navigation lights failing, the indicating lamp corresponding to that particular light is extinguished immediately. At the same time the armature of the series coil falls away and, in doing so, completes the circuit of the bell. In the case of navigation lamps having double filaments, when one filament breaks the indicating lamp continues to burn, but with diminished brightness, and the bell does not ring. If the second filament should then break the indicating lamp is extinguished immediately and the bell will ring.

The decorative element of lighting is predominant in saloons and the fixtures may be of almost any design, usually in keeping with the design of the compartment. It is, however, necessary to particularly avoid glare and hard shadows. An intensity of 2 to 3 foot-candles is suggested as being adequate for this purpose. It is, however, almost impossible to employ high candle-power units because of the small head room, and this almost invariably means the use of a number of small units to obtain an even illumination.

There are apparently two general ways of illuminating a writing room or library: (1) By a general illumination of 1 to 2 foot-candle intensity, supplemented by table lamps or sconces; (2) by a much higher general illumination so designed as to be thoroughly diffused, having a value of 4 foot-candles.

In dining rooms, again, there are two methods of lighting: (1) By means of a general illumination, supplemented by table lamps; (2) by a higher general illumination. A foot-candle intensity of 2 to 3 is suggested.

It is usually somewhat difficult to illuminate engine rooms adequately on account of the multiplicity of overhead pipes, girders, ladders, &c., but, by making the surroundings light and, if at all possible, white, a vast improvement is obtained. It is usual to install well-glass fittings with 30-watt lamps, but, if these are used in very dark surroundings, the effect of glare is apparent It is accordingly suggested that the engine rooms be lighted as far as possible with fittings provided with some means of obscuring the source of the light, and this may be done by shades or opalescent globes. It is important that all gauges and indicators be provided with local lights which have the source of light obscured from the eyes. Provision of good lighting, and by that is implied that it be sufficient in intensity and properly screened, is necessary, as machinery has to be handled while it is in motion.

Boiler rooms are probably the most difficult parts to illuminate of all, in view of the lack of reflecting and diffusing surfaces. Consequently, when a bare lamp is used, a distinct degree of discomfort is experienced from glare which results in a diminution of acuity of vision. Local lights must again be provided over the gauges and indicators.

In the smoking room decorative effect is the chief thing to be considered, but adequate illumination must be provided in order that card games may be played without eye strain. Two to three foot-candles should be sufficient.

Where the decorations of state rooms and berths demand it, the electric lighting fittings should be so designed as to be in harmony. Such apartments are essentially bedrooms, but at the same time must be the lady's boudoir, the gentleman's dressing room, and they are not uncommonly called upon to take the place of the hospital ward; it is here that the lack of comfort is most noticeable. A warm and cosy effect is required, but at the same time sufficient illumination is necessary for the dressing table. A general illumination of 1 to 2 foot-candles seems necessary, supplemented by local lights.

The lighting of decks offers several interesting problems. On sailing vessels an engine of relatively small dimensions driving a dynamo might deserve consideration simply for the purpose of providing artificial illumination unaffected by the wind, apart from its possible utility as a subsidiary means of driving the ship against adverse tides, &c. Unduly powerful deck-lighting might be objected to on the ground of its interfering with a look-out into the darkness; this condition implies care in avoiding exposure of sources to the eye. Lamps should be shaded and the order of illumination on the deck-surface need not exceed that customary for safety in factories and yards on land.

The lowering of boats is always a matter of some difficulty and lighting for such a purpose should be of considerable help. In some vessels lights are suspended between the davits and are available for use both for lowering and loading the boats. A sufficiency of light for taking on and storing cargo is necessary, going far in the prevention of accidents. In practice it is usual to have lighting units suspended over the coal and cargo hatches, and slung up in other places to facilitate the handling of material. Some vessels employ arc lamps, but more recently the gasfilled lamp in focus type reflectors has been used with success.

When a ship is loading or unloading at the port, supplementary illumination from the supply on land may be pro-

vided, and there are important possibilities in this direction. Portable units of the "floodlight" type can be effectively used to aid in the handling of goods by night and also to facilitate ship-construction and repair. In view of the frequently congested state of traffic at docks the use of artificial light to assist night working and shorten the period during which the ship remains in port is obviously important.

The lighting of ports and dockyards forms in itself a large subject, and presents difficulties by reason of the very extensive area that requires illumination. In these circumstances the order of illumination available is necessarily low, and it is all the more important to ensure that this light is distributed as efficiently as possible and to avoid glare from unscreened lamps within the range of vision, such as is liable to cause accidents.

Even in modern vessels the lamps still experience a considerable amount of vibration of high frequency. Helical traction lamps bid fair to entirely replace the old carbon lamps.

Of recent years the introduction of gasfilled lamps on board ship has made considerable headway, particularly in the large sizes for the purpose of illuminating the decks and for the facilitation of handling goods, and they appear to be quite satisfactory and are giving good life.

The economic feature of distribution does not call for a high voltage system on board ship because of the comparatively small area which has to be supplied with electricity compared with the amount of energy developed. In view of this fact 110-volt circuits are predominant, although some of the latest vessels which have been constructed have been provided with 220-volt circuits, but lamps operating on the higher voltage are not quite so robust in view of the fact that the filament is small in cross sectional area. There is a further point to be noted. In the case of gasfilled lamps the efficiency of the lamps of lower voltage is 10 or 15 per cent. greater than that of those operating at higher voltage, *i.e.*, for the same wattage 10 or 15 per cent. more light is obtained.

A standard voltage should be introduced on board ships of the Navy and Mercantile Marine. At the present time the various voltages and types of lamps which are asked for, even in different vessels in the same service, increase the expense of manufacturing lamps in bulk, and make it more difficult to produce lamps of good uniform characteristics. A further fact to be borne in mind is that boats are often in port only two or three days, and supplies of lamps consequently have to be dispatched at very short notice. It would greatly facilitate matters if lamps for only one, or at the most two, voltages had to be stocked for marine work in order to deal with these rush orders.

Discussion.

Mr. F. Purser Fletcher (Admiralty) said there was probably nothing in common between the lighting of merchant ships and men-of-war. On some merchant ships they had 10,000 lights, whereas in the largest ship in the Navy there were not many more than 3,000, and the lighting was simply required to be sufficient to allow instruments to be read and to provide a reasonable degree of comfort in the mess rooms, cabins, and compartments of the ship. In battleships the low head-room made it impossible to use reflected lighting with any great degree of success. He had tried to illuminate the different spaces of ships so as to avoid eye-strain, but with the poorest degree of success. With regard to the lighting of boiler glasses at sea, one could have a high candle-power on the boiler fitting, but unless it were directed on to the level at the right angle the results were very unsatisfactory. The illumination given by 32 c.p. at a distance of 4 ft. and projected on to the boiler glass at an angle of about 10 deg. below the water level gave by far the best indication of the water level. In merchant ships the dynamos were near the upper deck, but it was the reverse in the Navy, and there was likely to be trouble with water in the event of the compartment being flooded. The same condition occurred with the wiring. It was difficult to arrange water-tight fittings to be satisfactory in the event of flooding of the compartment.

The American Navy's figures specifying the different degrees of illumination required were useless unless it were specified at what plane the intensity of illumination was to be given. In the merchant service one could use high candle-power gasfilled lamps with considerable satisfaction, but in the Navy it was not at present possible to use them in view of their frailty and inability to withstand the shock effects of gun-fire. Helical traction lamps appeared to be the most suitable for illumination under conditions of gun-fire and shock. In the electrical engineering department of the Navy attempts were being made to get artificial light similar to daylight. Sheringham shades and various types of daylight glass had been tried in order to get conditions that would not produce eye-strain. With all such systems the nearer one got to daylight the worse was the efficiency. In some cases one only got 30 per cent. and in some less.

Lieut.-Com. J. W. A. Waller (H.M.S. *Vernon*) said it was the custom in the Navy to use twice as much candle-power in the starboard light as was used in the port light, on account of the absorption in the green glass compared with the red.

Mr. P. J. Waldram said that in a chart-room amply lit the reading of the chart would not be so easy as it would in a chart-room somewhat badly lit generally, but with the charts themselves well illuminated from below, which he believed was the custom in the Navy. It would be impossible under sea conditions to light the deck with constant efficiency, and it was better under those conditions not to light it at all. On a ship failure of the electric lighting system generally synchronised with other emergencies which rendered it vital that men should be able to get to their stations at once. It was obviously highly dangerous to cause them to do so with their sense of feel, direction, and touch partially atrophied by having been able to go about their work at night under conditions of ideal safety.

The Chairman (Mr. C. H. Wordingham) said the rules issued by the Intitution of Electrical Engineers went much further than lighting, and referred to the whole of the electrical equipment of ships. The Institution rules as adopted by Lloyd's were now in a fair way of becoming universally recognised all over the world. A complete series of interchangeable weather-proof fittings was provided, and standard pressures had also been set up in those rules, and were likely to be worked to. On the smaller ships 110 volts was sufficient, but on the larger ones 220 volts had such great advantages that it would be very largely adopted. He did not think it was necessary to go so high as 440 volts, but the tendency was in the direction of higher pressures. A question that had a bearing on illumination was the enormous diversity in the load on a ship. There were many motors that were only used when the ship was at sea and others that could only be used in harbour. Having provided the generating capacity for those motors, a large part of the cost of providing for ample lighting—*i.e.*, the part which was involved in standing charges—was already incurred, and therefore one could afford to light liberally. It had not the same effect on the fuel, but the amount of fuel used in producing light was negligible in comparison with the fuel required for propelling the ship. This diversity came in again in connection with the ring-main system, which he (the chairman) used in the Navy. He introduced it and defended it against all comers, because it largely reduced the amount of copper necessary for the main distributing conductors. At the same time, every point had a duplicate means of supply.

LONDON AND HOME COUNTIES ELECTRICITY DISTRICT.

The Electricity Commissioners' Decisions.

The Electricity Commissioners have considered the evidence given at the inquiry held by them at the Institution of Electrical Engineers (from June 14th to July 29th, 1921) into the schemes submitted respectively by the (*a*) London County Council, the Conference of Local Authorities in Greater London, and the London Joint Committee (1920), Ltd. (hereinafter referred to as the Associated Companies); (*b*) Poplar Borough Council for a part of the area; and (*c*) the proposals made by the Great Eastern Railway Co. and the London, Brighton & South Coast Railway Co. respectively, all of which have been outlined in this journal.

The Commissioners' reasoned statement of their decisions records, *inter alia*, their gratification at finding a large measure of agreement between the promoters of the three principal schemes submitted, who all agree that an improvement in the present position is urgently needed, and that a Joint Electricity Authority, representative of all interests, should be established without delay to carry out the necessary reorganisation. There is general agreement as to the functions of such a Joint Authority and considerable approximation of view regarding its constitution.

An agreed technical scheme was presented by the principal promoters. The Associated Companies agree to vest their generating stations forthwith in a Joint Authority upon certain conditions; the London County Council agrees to transfer to a Joint Authority its rights of purchase of the company undertakings and, in consideration of the immediate transfer by the companies of their generating stations to the Joint Authority on certain terms, agrees to a postponement of the purchase of their distribution systems; the Conference of Local Authorities agrees generally to the control by, or transfer to, a Joint Authority of the local authority generating stations, and to a settlement with the companies on the lines indicated.

The Commissioners are of the opinion that the district cannot be adequately dealt with if the areas over which the rights of the North Metropolitan Electric Power Supply Co. and the Metropolitan Electric Supply Co., Ltd. (so far as its bulk supply area is concerned) extend are excluded, but they consider that these companies require special treatment, as indicated later. They therefore confirm the provisionally-determined district,* subject to the following minor fringe amendments, namely:—The inclusion of the whole of the rural districts of Billericay, Epping, and Ongar, in the county of Essex; the detached part (lying between the rural districts of Ware and Epping) of the parish of High Wych, in the rural district of Hadham, in the county of Hertford; the parishes of Penn, Coleshill, and Amersham, in the rural district of Amersham, in the county of Buckingham; the parishes of

* Elec. Rev., July 23rd, 1920; p. 106.

Shalford and St. Martha, in the rural district of Hambledon, and the parish of Artington and part of the parish of Compton, in the rural district of Guildford, in the county of Surrey; and the exclusion of the parishes of Sunninghill and Sunningdale, in the rural district of Windsor, in the county of Berks.

The Commissioners are unable to accept the scheme of the Poplar Borough Council, but a Joint Electricity Authority will be established for the district on the lines proposed in the schemes promoted by the London County Council and the Conference of Local Authorities, and a body constituted as follows would meet the requirements of the district:—Local authorities, 8; companies (London 6, outside London 1, power 1), 8; London County Council, 6; other county councils on their own behalf and on behalf of the urban and rural districts not owning undertakings (Middlesex and Bucks, 1; Hertfordshire and Essex, 1; Surrey and Kent, 1), 3; railway companies, 1; and the chairman, if elected from outside, 1; or a total of 27 representatives.

The estimates submitted in the joint technical scheme for the first and second stages of development indicate that for the year 1919-20 the total demand in the district was 360,600 kW, and that 608,000,000 kWh were sold, the average annual load factor being 21.6 per cent. The three principal promoters agree on the estimate of growth during the next ten years; about 1925-6 the demand will be 465,000 kW, and the kWh delivered to authorised distributors will be 1,057,000,000, at an average annual load factor of 25.9 per cent.; also about 1930-31 the actual demand will be 660,200 kW, and the kWh delivered to authorised distributors will be 1,520,000,000, at an average annual load factor of 26.3 per cent. These estimates do not include supplies to railways for traction purposes; they were not challenged at the inquiry, and the Commissioners accept them as reasonably accurate forecasts of the future requirements, excluding special railway supplies.

The Commissioners concur generally in the technical proposals for dealing with the requirements during the *first* stage, terminating about 1925-6, for which they have already authorised the necessary generating plant. The additional capital required beyond that involved in providing this plant, will be practically limited to that needed for inter-connecting mains between grouped stations, thereby enabling the fullest use to be made of existing and authorised extensions of generating plant amounting to 633,000 kW in all, and setting free otherwise reserve plant for revenue-producing purposes.

Regarding the proposals for dealing with the *second* stage, the Commissioners differ from the promoters, who proposed to continue the development of certain existing "group" stations and to install in them a further 199,000 kW of generating plant, thus bringing the plant installed in "group" and other stations about 1930 to a total of 832,000 kW and involving new capital amounting to £9,750,000.

The alternative proposal provided for the installation of 645,000 kW of generating plant in capital stations, and the reduction of the 557,000 kW of plant installed in the "group" stations to 232,600 kW, thus involving the throwing aside of 324,400 kW of plant long before the end of its economic life. This alternative involved new capital expenditure amounting to £23,855,000.

The Commissioners' conclusion is that a better way is to install the 199,000 kW of generating plant in a capital station or stations while retaining the "group" stations as developed during the first stage. As compared with the estimated annual cost of electricity supplied to the busbars of authorised distributors—namely, £7,262,700, or 1.147d. per kWh under the technical scheme, the Commissioners' proposals should enable electricity to be delivered at a cost of £6,190,700, or 0.978d. per kWh (an annual saving of upwards of £1,000,000, or 15 per cent.), with all the advantages derivable from a capital station, such as availability for large railway or other supplies in bulk at favourable rates.

For proper evolution beyond the first stage ("group" station proposal), the further plant required during the *second* stage should be accommodated in a well-placed riverside station or stations which would generate on a large scale at a high load factor, the local stations meeting the remaining low load-factor demands and the peak loads. Such a modified combination would minimise the outlay upon and the costs of transmission from the capital station, and would make the fullest use of the capital invested in existing stations. It would lessen the estimated coal consumption by 10 per cent. and reduce the average cost of electricity delivered to authorised distributors by 15 per cent., as compared with the proposals submitted to the Commissioners. These savings would be *additional* to the substantial savings outlined in the technical scheme, as compared with existing conditions.

The Barking site should be utilised for the construction of the first capital station on which the County of London Electric Supply Co., Ltd. is prepared to begin immediately the construction of a 100,000-kW station. The company, by virtue of its Act of last session, can be called upon at any time before August, 1926, to sell this station to a Joint Electricity Authority upon terms to be prescribed by the Commissioners, who are of the opinion that the station will be needed to reinforce existing sources of supply before 1926, and are prepared forthwith to give their consent to its establishment.

The Commissioners are not in accord with the views that a Joint Authority would be unable to generate more cheaply than a railway company possessing its own generating station, and they are of the opinion that a combined supply from a common source will be advantageous to both parties. They fully anticipate that co-operation will be forthcoming in the practical working out of the technical scheme under the ægis of the Joint Authority, and that, excluding stations owned by the power companies, only six or seven of the principal company stations and a like number of the local-authority stations will ultimately survive as generating stations; it is more particularly these stations which should vest in the Joint Authority. The remainder, of which about 50 will be gradually closed down, can be incorporated in the scheme of reorganisation under the control of the Joint Authority.

There is a far-reaching measure of agreement on this matter between the Associated Companies, the L.C.C. and the Conference of Local Authorities, and it appears that it should be possible by agreement to settle terms of transfer of the selected stations on an equitable basis. Negotiations on these matters are still proceeding.

Regarding the extension of the tenure of the distribution powers of the supply companies in London, which may be terminated by purchase in 1931, the Commissioners conclude that a substantial extension of tenure would be more conducive to the stability of these undertakings and to their efficient development than the existing short period with recurring rights of purchase at short intervals, but that any such extension should be coupled with a reasonable sliding scale of price and dividend. The Order establishing the Joint Authority will be so drafted as not to interfere with the rights of the North Metropolitan Electric Power Supply Co. or with the bulk supply rights of the Metropolitan Electric Supply Co., Ltd., will provide for the delegation to those companies of the supply powers of the Joint Authority in their respective areas, and for the submission by each of them (within a period of two years) of proposals for supplying undeveloped areas where there is a reasonable prospect of such a supply being remunerative. Arrangements for mutual assistance between these companies and their neighbours will be facilitated, and it is proposed that in the apportionment of the administrative expenses of the Joint Authority, the contributions of these companies shall be limited, having regard to their special positions and powers.

With regard to finance, the authorised undertakers should find the funds for all extensions of generating plant at their stations while such stations remain in their possession, and for any inter-connecting mains required before the Joint Authority is in a position to act. The capital moneys necessary for the construction of additional inter-connecting mains and for the erection of capital stations should be raised by the Joint Authority under powers of borrowing to be conferred by further legislation. The Associated Companies submitted definite proposals for financing the Joint Authority during the initial period up to a sum not exceeding £1,200,000, and the London County Council and the Conference of Local Authorities expressed their readiness to assist with municipal credit, if powers were obtained in that behalf, and the scheme as finally approved were satisfactory to them.

The observations of the parties represented at the inquiry will be invited on the clauses of the draft Order before the Commissioners hold the further inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919.

NEW ELECTRICAL PROPOSALS FOR THE CONSIDERATION OF PARLIAMENT.

We give below a list of proposals that will come before Parliament early in the new year. Readers who are desirous of obtaining further information will find the applications published in the *London Gazette* for November 22nd and 25th.

(a) Electric Light and Power.

Blackburn Corporation.—Extension of area of supply; construction and working of new tramways; power to run omnibuses; further powers with reference to tramway and electricity undertakings; financial provisions, &c.

London and Home Counties.—Powers to carry out schemes approved by the Electricity Commissioners under the Electricity (Supply) Act, 1919, constituting as a separate electricity district under or for the purposes of the Act of 1919 the whole or any part of the area comprised within and being the counties of London (including the City of London), Middlesex, Berks, Buckingham, Essex, Hertford, Kent and Surrey (including the county boroughs of East Ham, West Ham, and Croydon), or any scheme so approved or formulated.

Swansea Corporation.—Extension of limits for supply. Corporation to be the purchasing authority for tramways in the added area. Financial provisions, &c.

South Wales Electrical Power Distribution Co.—Reduction of capital by cancelling capital unrepresented by assets, conversion of Ordinary and Preference shares into stock; provisions as to price of electricity and revision thereof; methods of charging; supply of electricity to parish of Bettws; agreements with local authorities to subscribe to

capital and other securities of the company and of the Treforest Electrical Consumers' Co., Ltd.

Yorkshire Electric Power Co.—Sub-division of ordinary and preference shares and provisions incidental thereto.

Worthing Corporation.—Supply of electricity in parish of Durrington, supply of fittings, electricity in bulk, and general provisions.

North Metropolitan Electric Power Supply Co.—Revision and alteration of prices and methods of charging by North Metropolitan Electric Power Supply Co. and North Metropolitan Electrical Power Distribution Co., Ltd. Transfer of undertakings and orders of said Distribution Co. to Power Company and dissolution of Distribution Company. Increased borrowing powers and other financial provisions. Bulk supplies from Metropolitan Railway Co. and North-Western Railway Co., and repeal of existing limitations. Profit-sharing schemes, &c.

Neath Corporation.—Extension of the borough boundaries; supply of electricity in added areas; transfer of electricity undertaking and rights of Neath R.D.C. to Corporation and repeal of Acts; supply to Corporation of electricity in bulk by South Wales Electrical Power Distribution Co.; power to alter method of charging for electricity; financial provisions, &c.

(b) Electric Tramway, Motor-'bus, and Railless Trolley Vehicles.

London County Council.—Construction of new and reconstruction of existing tramways; electrical traction; provision and working of trolley vehicles; financial provisions, &c.

Northampton Corporation.—Extension of time for construction of tramways, &c.; power to run motor omnibuses; financial provisions; further powers.

Birmingham Corporation.—Further provision as to trolley vehicles, tramways, and omnibuses; financial provisions.

Doncaster Corporation.—Power to provide and run motor-omnibuses. Further powers in connection with light railway undertaking; increase of fares and charges on ditto; further powers with reference to the electricity undertaking; financial provisions, &c.

Nottingham and Derbyshire Tramways Co.—Power to construct additional tramways in the urban district of Heanor, the rural district of Basford, and the borough of Ilkeston. Increase of fares; further provision as to existing and proposed tramways; repeal or amendment of Tramways Act, 1870, with respect to acquisition of proposed tramways by local authorities; financial provisions, &c.

Black Country Tramways and Light Railways.—Postponement of dates for compulsory purchase of undertakings, tramways, or light railways of the Birmingham District Power and Traction Co., Ltd., the South Staffordshire Tramways Co., the South Staffordshire Tramways (Lessee) Co., Ltd., the Dudley, Stourbridge, and District Electric Traction Co., Ltd., the Wolverhampton District Electric Tramways, Ltd., and the British Electric Traction Co., Ltd. Extension of terms of leases to certain of the companies, synchronisation of dates for compulsory purchases and extension of leases, &c.; prohibiting compulsory purchase of undertakings of all or any of the companies unless the undertakings of all or some of them are so purchased. Fares, rates, and other general and incidental provisions, &c.

Bristol Corporation.—Construction of tramways in City of Bristol; provision of trolley vehicles; powers to borrow for purposes of Act; general and incidental provisions.

Bristol Tramways and Carriage Co., Ltd.—Extension of time for completion of authorised tramways; acquisition of part of site of generating station; revival of powers and extension of time therefor; special provisions as to terms of purchase; repeal, extension, and amendment of Acts.

Jarrow Corporation.—Powers to run omnibuses within and without the borough.

Bolton Corporation.—Construction of tramways in Bolton and Westhoughton; use of trailer cars; fares and charges; powers as to running of omnibuses within and beyond Bolton; construction of electrical sub-station and further powers as regards electricity supply; provision of electricity show rooms; financial provisions.

(c) Railways, &c.

Thames Deep-water Wharf and Railways.—New company; powers to construct wharf, railway, and electricity generating stations; working of railway by steam or electricity; supply electrical energy; arrangements with the Midland and G.E.R. Co.'s; powers to run omnibuses, motors, coaches, &c.

London, Brighton & South Coast Railway.—Powers for the raising of additional money by borrowing or issue of Debentures or Debenture stock for the general purposes of their undertaking (including the equipment of the railways for electric traction) or for such special purposes (if any) as may be specified in the Bill, &c.

North-Western and Midland Group Railways.—Powers to L. & N.W., Midland, L. & Y., N. Staffs and Furness Railway Companies to provide and use road vehicles (omnibuses, motor-cars, &c.) for the conveyance of passengers and goods, &c.

Metropolitan Railway Co.—Power to guarantee or subscribe towards any loss or deficiency which may result from the preparation for or holding of an exhibition by the British Empire Exhibition (1923), Incorporated, &c.

Trafford Park Co.—Construction of railways; electrical power for working railways; provide trolley vehicles in Stretford Urban District and in Rural District of Barton-upon-Irwell and the Borough of Eccles, &c.; additional share and loan capital; power to obtain electrical energy from Manchester Corporation.

Post Office (Pneumatic Tubes) Acquisition.—Acquisition by Postmaster-General of underground works of Pneumatic Despatch Co., Ltd., and maintenance, reconstruction and user thereof for Post Office purposes.

BRITISH WATER-POWER RESOURCES.

The final report of the Water Power Resources Committee, of which Sir John Snell is the chairman, was issued last week (H.M. Stationery Office, price 8s. net).

The Committee was appointed in June, 1918, by the President of the Board of Trade to examine the extent and the availability for industrial purposes of the water power resources of the United Kingdom; in October, 1919, it was enlarged and directed to consider also what steps should be taken to ensure that the water resources of the country were properly conserved and fully and systematically utilised for all purposes. So far as Ireland was concerned, both inquiries were carried out by a Sub-Committee appointed directly by the President of the Board of Trade. The report of this Sub-Committee has already been issued. The following is a summary of the chief findings of the Main Committee:—

Water Power.—From the outset the Committee realised that, with the limited financial means at its disposal, it would be impossible to undertake a complete survey of the water power resources of the country, and it concentrated upon obtaining particulars of as many schemes as possible for utilising particular sources which appeared likely to prove commercially practicable. Actual surveys were undertaken in a number of areas, and schemes from Government Departments and other sources were also examined. The report and evidence obtained, which do not purport to be exhaustive in any way, establish a *prima facie* presumption that some 210,000 kilowatts in the form of electric power can be developed continuously day and night throughout the year at an economic rate from those British schemes which were considered. Similarly, the Irish Sub-Committee considers that from a portion only of the water power resources of Ireland a continuous output of 113,000 kilowatts can be obtained. The Committee points out with regard to Great Britain that the potential electrical output of the commercially practicable schemes before it is equal to about 40 per cent. of the total output in the year 1917-1918 of the 410 British public electricity supply and electric railway and tramway undertakings operated by steam power; also, that the development of this amount of energy in steam stations would involve the consumption of nearly three million tons of coal per annum.

The bulk of the larger British water powers are found in the Scottish Highlands; although this district is situated at some distance from the present great industrial centres, no part of it is far from the sea or the Caledonian Canal. The Committee points out that the utilisation of the Scottish water powers might do much to assist the depopulation of the Highlands.

The larger water powers of Wales are situated in the North-Western part of the Principality. The proposals of the North Wales Power & Traction Co., Ltd., which involve the utilisation of several large water powers in this district for public electricity supply purposes, have already received the approval of the Electricity Commissioners.

In England the main sources of water power are the small falls on rivers; although the power available at any particular site is small, the aggregate output that might be obtained by improving these sites, by installing modern turbines in the place of inefficient plant at existing sites, and by general improvement of the water-courses, is considerable. As a typical case, the Wiltshire Avon may be cited. At present plant is installed or about to be installed to generate in the aggregate 650 kilowatts, but investigation showed that an additional output of 2,300 kilowatts could be obtained. An examination of the Lake District did not reveal any large water power capable of commercial development.

The Committee considers that every inducement should be given to persons interested in power production to utilise for their requirements a perennial source of energy like water power rather than a wasting asset like coal, and recommends that the collection and publication of information regarding potential water powers should continue, and that financial assistance might be afforded by the State to water-power undertakings during the difficult years of the constructional period.

A haphazard harnessing of the country's water power may, however, lead to partial developments which would prejudice the ultimate complete utilisation of the available resources,

and thus result in considerable waste. It is necessary, therefore, that some control over development should be exercised in the national interest. The Committee considers, further, that provision should be made for the ultimate acquisition by the State of all future water-power undertakings, and proposes a system of terminable licences, usually of long term, for limiting the tenure of the undertakers of water-power developments.

It is suggested that either the Board of Trade or the Electricity Commissioners should be specifically charged with the duty of studying, supervising and promoting the development of water power.

As regards tidal power, the Committee reiterates the recommendation made in its Third Interim Report, that this subject should be specially studied by a Technical Commission, with particular reference to the Severn Estuary, with regard to which a considerable amount of information has already been accumulated.

General Water Resources.—A great number of different interests are concerned in the available supplies of water. The predominant requirement is necessarily an adequate supply for domestic and sanitary purposes, but in any proposal involving the use or abstraction of water, the claims of steam and water-power plants, trade and industrial consumers, and canals and navigable waterways need to be considered, and the prevention of pollution, the protection of fisheries, and the needs of agriculture from the standpoints of land drainage, irrigation and watering of stock have to be borne in mind. In Scotland the water resources are, comparatively speaking, abundant, and the population over considerable areas is sparse, and in consequence the conciliation of opposing interests can be effected by the Government Departments concerned, most of which are responsible to one Parliamentary head, the Secretary for Scotland. In England and Wales, however, the increase of population and the growing requirements of industry are responsible for a steadily increasing demand for water, and the problem of meeting future needs is giving rise to considerable anxiety. The Committee recommends, therefore, that a Water Commission, having jurisdiction over England and Wales, should be appointed mainly for the following purposes:—

(i.) Subject, in case of opposition, to Parliamentary sanction, to allocate the water resources of England and Wales in the general interests of the community, and to re-adjust existing allocations of water where hardship or anomalies are shown clearly to exist.

(ii.) To adjust conflicting interests in connection with the use of water for a particular purpose.

(iii.) To afford assistance to Parliamentary Committees before which Bills relating to water may be heard, and to Government Departments concerned in the use and control of water for specific purposes, and also to the various local authorities and water-supply undertakings.

It would be necessary for the Commission to collect and compile data relating to water resources in order to enable it to perform its function efficiently, and it is proposed that this information should be made available to the interested public through the medium of a special indexing system, which the Committee has worked out in some detail.

It is proposed that the expenses of the Water Commission should be defrayed in part by a levy on the water undertakings in England and Wales, and in part by the fees of applicants for powers to undertake works.

The Irish Sub-Committee recommends the constitution of an Authority to allocate water between the several interests in Ireland.

It is proposed that, with a view to eliminating waste of both time and expense, the departments concerned with the various water interests should be empowered to authorise promoters of unopposed schemes to carry out the proposed works; in the case of an opposed scheme, the Order of the Department should be Provisional, and require confirmation by Parliament.

LEGAL.

The Birkdale Electric Supply Co., Ltd. *v.* The Southport Corporation.

The action of the Attorney-General at the relation of the plaintiffs against the Southport Corporation, was again mentioned to Mr. Justice Peterson in the Chancery Division on December 16th.

Mr. Tyldesley Jones said that the case raised the question as to the right of supplying electricity in that part of the borough of Southport which was formerly known as Birkdale. The plaintiffs' case depended partly upon their rights and powers under a certain agreement, and partly on a question of *ultra vires*. It would be impossible to try such a case on a motion, and the parties had agreed, subject to his Lordship's sanction, to allow the motion to stand until the trial of the action, and to ask leave to apply for an early hearing. It was important to both parties that the matter should be disposed of as quickly as possible. The Corporation were as anxious as the plaintiffs in order that they might know what their rights were. The case would take at least two days, as there were agreements, provisional orders, and Acts of Parliament which would have to be carefully examined.

His Lordship said he would give liberty to the parties to apply to expedite the trial of the action when they were ready. There would be no order on the motion except that the costs be costs of the action.

Edye and Others *v.* South Metropolitan Electric Tramways. Co., Ltd.

In the King's Bench Division, Mr. Justice Swift, on December 16th, concluded the hearing of an action brought under Lord Campbell's Act respecting the death of a man named John William Edye, in which his widow, infant children, and his mother claimed damages against the defendant company.

Mr. Holles Walker, K.C., appearing for the plaintiffs, said that the deceased man died leaving a will, and under the circumstances the proceedings ought to have been in the name of the widow and the brother, who were co-executors. He asked, therefore, that the brother might be added as plaintiff.

No objection being raised by the defendants, Mr. Holles Walker, continuing, said that the deceased man was 39 years of age, and carried on business as a credit draper, and was in the habit of going round to his customers on a motor cycle. On June 16th of last year he was riding his cycle, with his assistant in the side car, along the road from Mitcham to Croydon, which had in the middle a double set of tram-lines. There was no footpath adjoining the road, and pedestrians had to walk on the common. Mr. Edye was proceeding in the direction of Croydon, and in front of him going in the same direction was a steam wagon, and behind that was a motor lorry, which was going faster than the steam wagon. The driver of the lorry endeavoured to pass the steam wagon, and in doing so came upon the tram-lines. He came to a spot where the setts were so worn down that the metal rail stood out about an inch above the road. The motor came against the obstruction, skidded, and came in contact with the motor cycle, knocking it over, and so injured the driver that he died shortly afterwards. The South Metropolitan Co. were the owners of the line, and plaintiffs contended that the accident was due to their neglect, as they were bound to keep the line in a safe and satisfactory condition.

Evidence was given as to the condition of the road and bearing out counsel's statement as to the manner in which the accident happened, but the driver of the lorry which ran into the cycle was not called.

Mr. Manly, the Tramway Co.'s electrical engineer, who examined the line after the accident, said that an examination of the track disclosed no defect. His examination extended over a length of 80 yards, and he found the line to be in excellent condition with the exception of a depression in the clear way on the off side, and that depression was in the centre, three-quarters of an inch below the level of the stone setts.

The case for the defence, which was supported by a number of witnesses, was that the accident was caused, not by the condition of the line, but by the manner in which the lorry had been driven.

His Lordship, in giving judgment for the plaintiffs, said there was no evidence of negligence on the part of the driver of the lorry, and he was satisfied that the accident would not have happened had it not been for the depression in the road. He thought the accident was consequent upon the neglect of the defendants to repair the road, which was in a dangerous condition. In assessing the damages, he had to consider, not what was the particular loss to a particular member of the family, but what was the loss to the family as a whole, and after having done that he had to apportion the award. The deceased was carrying on a prosperous business, which was bringing in about £10 a week. Taking all the circumstances into account, he awarded to the family in all £2,000, of which the mother would receive £200, the widow £300, two children (8 and 9 years of age) £450 each, and the third child (which was 3 years of age) £600.

Charge of Stealing Lamps.

At the Bow Street Police Court last week, E. A. Kann, of Barnes, was charged with stealing 3,600 electric lamps (value £360), the property of the General Electric Co., Ltd. He was remanded, bail being allowed. According to the *Evening Standard*, the solicitor for the prosecution said that accused had been in the employ of the company as assistant to the manager of a lamp department at a salary of £420 a year. It was alleged that he caused the 3,600 lamps to be sent out in the first instance to a customer who had not ordered them, and that he subsequently fetched them away from that customer and sold them, in the name of Lyons, to another firm at a price much below their value. The firm in question communicated with the prosecutors.

British Thomson-Houston Co., Ltd., v. Corona Lamp Works, Ltd.

Judgment was unanimously given for the appellants in the House of Lords on Monday by Lords Haldane, Finlay, Cave, Dunedin, and Shaw in the British Thomson-Houston and the Corona Lamp Works, Ltd., litigation over the alleged infringement by the latter of Letters Patent No. 10,918 of the year 1913, for an invention entitled "Improvements in Incandescent Electric Lamps." The British Thomson-Houston Co. brought an action for an injunction to restrain the Corona Co. from infringing the Letters Patent, but Mr. Justice Sargant held that they were invalid on the ground that the specification did not sufficiently define the ambit of the monopoly claimed. The Court of Appeal affirmed this decision, also on the ground of insufficiency, so the matter was taken to the House of Lords by the appellants, where judgment was reserved on the 22nd of last month, after a very long hearing.

Lord Haldane, who first delivered judgment, said in the litigation out of which this appeal arose the appellants were plaintiffs, and they brought their action to restrain infringement of a patent, taken out in 1913, and an electric lamp in which the filament incandesces in an atmosphere of gas or vapour of low heat conductivity, instead of, as was still usual, in a vacuum. The respondents, who were defendants, denied infringement, but their substantial defence was, first, that the patent was invalid for want of subject-matter, having regard to the state of knowledge at its date, and, further, that the patent did not describe sufficiently the character of the alleged invention, with the result that its directions were ambiguous and misleading. Mr. Justice Sargant, who tried the action, held that there was valuable and good subject-matter disclosed in the patent, but that it was bad in that it failed sufficiently to define or limit the ambit of what it claimed. The Court of Appeal affirmed this conclusion.

In the Courts below the controversy turned mainly on the second defence, that of ambiguity in statement and insufficiency in directions. At the Bar of the House of Lords this question had, indeed, remained prominent, but its prominence had been less than that of the prior question of subject-matter, on which the Courts below were adverse to the respondents. The primary controversy in that House had been whether subject-matter had been sufficiently established, as consisting in an invention really new in point of principle, and if so, then whether the claiming clauses and directions in the patent were sufficient to inform people, assuming them to possess skill in the manufacture of electric lamps, how to apply the general principle in particular ways. As to the methods recommended, the question was whether those given were clearly enough described; for, if so, and if the fundamental principle had been explained, it did not matter, for the ambit or discovery claimed, if there were alternative methods of applying the principle which were not given exhaustively, provided these were no more than mechanical equivalents to the particular methods prescribed. Lord Haldane gave a lengthy history of the state of matters previous to the date of the present invention, and said the general situation prior to 1913 was as follows: tungsten had been substituted, with practical advantage, for other metals and for carbon. The tungsten filament was introduced into a carefully produced vacuum, and this vacuum rendered a substantial amount of vaporisation, with consequent blackening of the bulb, inevitable. It was known that inert gases could be employed, which would fill the vacuum and greatly diminish vaporisation, and among such known inert gases was argon; but, on the other hand, the introduction of any gas gave rise to conduction and convection to such an extent that the temperature of the filament became too low for incandescence to take place, unless a current were sent through in an amount such that the filament was soon destroyed. The dilemma had seemed insuperable, for between 1882 and 1913 nothing had been accomplished to get rid of it, and manufacturers had accepted a tungsten filament in a vacuum as the only practical method for commercial success.

In 1913 the patent of that year was taken out in this country, embodying an invention of Dr. Langmuir, an American physicist, whom Mr. Justice Sargant described as "a practical scientist of the highest qualifications." The idea underlying the invention was this. If the surface of the filament rendered incandescent by the current was increased in area it had been found by experiment that the light rays radiating from this surface increased in volume in a proportion much greater than that of the increase of temperature required to obviate loss due to conduction and convection by reason of the filament having been placed in an atmosphere consisting of an inert gas. By the introduction of such a gas into the bulb of the lamp vaporisation could be much reduced, and incandescence would be maintained if the current was made sufficient to replace the heat lost by conduction and convection. Under such a method the temperature could be preserved at a degree sufficient to render incandescent a larger surface than was possible in a vacuum where destructive vaporisation of surface was unavoidable. A larger surface than lamp makers had been accustomed to use could, therefore, be made to radiate light rays. It was shown that when this new principle was carried into effect about 10 per cent. increase of absolute temperature yielded proportionately three times the light formerly obtained. The discovery was thus the obtaining of a yield of light in a proportion to temperature much greater than under former methods. Light could now win heavily in what one of the expert witnesses called the "race" of light increase against heat loss.

The application of this principle, as a mere principle, of course could not have been patented. But the inventor claimed in his patent to have shown practical methods which embodied and could put it into operation. If he actually did so his invention was a patentable one. There was also the question whether the directions given in the words of the patent itself were sufficient, and whether its claiming clauses defined the invention unambiguously.

His Lordship did not think that in the patent before them it was intended to define, or that it was possible or necessary to define, the expression "large" as referring to any definite limits. All that was necessary was for Langmuir to tell the lampmakers how to get as large an incandescent surface as they wanted for their practical purposes. He made plain to them in the specification that this was no longer impracticable, and that if they would adopt his new process of manufacture they would attain a valuable commercial result, the outcome of the scientific principle implied in the process. He showed them how, by coiling a small filament, to get the large incandescent surface notwithstanding that the diameter of the filament was narrow, and one, therefore, requiring only a small amount of current. In this way the "Half-watt" lamp became attainable.

In the light of the directions given in the body of the specification, his Lordship thought that in the words there was claimed what had been already adequately described. It was, in his opinion, no mere abstract principle, but a method or process of manufacture, capable of being at once put into operation by any experienced electric lamp maker, with such adaptations as his commercial requirements and standards suggested. To put it into operation required no new inventive capacity, and it would have been inconsistent with the generality and sweep of the explanation given to have inserted a definition of the word large, otherwise than relatively to current practice. Such a definition, if attempted, would have limited unnecessarily the ground over the whole of which the new method was to be made operative. The principle and its working in practice need not be distinguished in the fashion which was required when the discovery was of some merely particular and qualified kind.

Mr. Justice Sargant in his judgment recognised fully the value of the invention, but he thought that there was a direction that the diameter of the coil was to be "substantially of the order of 10 mils, a figure clearly indicated by the specification as constituting a thick filament." No doubt a filament of such a diameter would be thick or large, within the language of indication. But when he went on to suggest that the illustration did not suffice, inasmuch as the claim was not, so far as size was concerned, definable quantitatively, but only by reference to other variables, he (Lord Haldane) could not agree with him. For the reasons he had given he thought that the claim was not one merely for articles falling within particular limits of size in filament, but for a general process of manufacture applicable in all the cases which practical experience allowed. That was because of the character of the pioneer invention which the patent described.

It was, in truth, an invention of an ingenious and useful process of manufacture in which the integers, so far as old, were combined in accordance with a principle that was new, and embodied a fresh invention. For these reasons he submitted that the judgment in the Court of Appeal should be reversed, and the appeal allowed with costs.

Lords Cave, Finlay, Dunedin, and Shaw concurred, and so the appeal of the British Thomson-Houston Co. was unanimously allowed with costs.

New Russian Stations.—It is stated that out of the comprehensive schemes for the "electrification of Russia," as projected by the Soviet Government, only four stations have so far been commenced, concerning one of which the Russian newspapers have published some information. This station is situated in the town of Kaschivia, about 75 miles to the south of Moscow, and in the vicinity of the railway to Tula. The site has long been regarded as suitable for the purpose because two banks, one Russian and one German, sought several years ago, to obtain a concession for the establishment of supply works in the town. The fuel used is an inferior kind of pit coal which exists in the neighbourhood; it resembles German lignite, and is suitable for firing steam boilers. The latter are 10 in number, on the Garbe and Sterling system, there are two steam turbines of 12,000 h.p. supplied by the Swiss Brown-Boveri Co., and the pressure of the generators is 3,000 volts. There are two Swedish transformers of the Luth & Rosen make, which raise the pressure to 115,000 volts, at which pressure the current will be transmitted to Moscow. The other three stations will be of a similar size, and the transformers for these have also been supplied from Sweden.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Win-Sum" Radiator.

Messrs. Tidd, Siday & Co., Ltd., 180, Drury Lane, W.C.2, have designed an apparatus for the provision of hot or cold air to rooms and buildings. This is the "Win-Sum" radiator, shown in figs. 1 and 2. It consists of a rectangular box 15 in. high, 20 in. long, and 13 in. wide, with a curved top. At one end of this is fitted a specially constructed motor-driven fan with speed-regulating resistance. At the other end

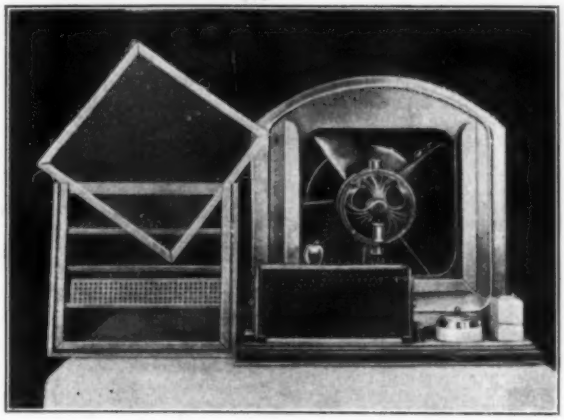


Fig. 1.—The "Win-Sum" Radiator—Fan End.

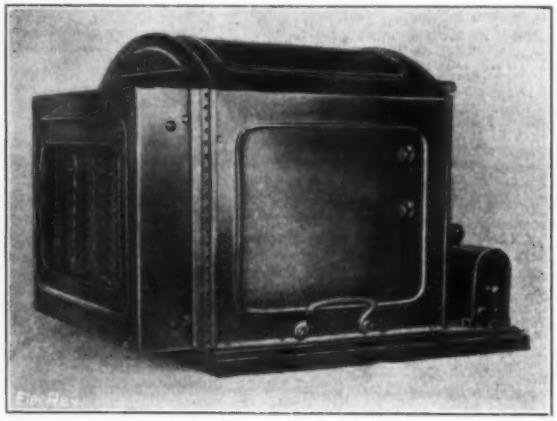


Fig. 2.—The "Win-Sum" Radiator—Heater End.

four independent heating elements are fixed (fig. 2). A double screen covers the fan end, and between the two parts of this, porous perforated slabs, impregnated with a deodorising or disinfecting fluid, may be placed. A baffling disk placed behind the fan prevents reverse air currents. Provision is also made for an ice chamber if this is required.

A Witton-Kramer Electric Pulley Block.

In most warehouses, workshops, and factories there occur from time to time instances of lifting and goods-handling work which, though not of sufficiently frequent occurence to justify the installation of expensive cranes or other transporting devices, render essential some form of power hoist. To meet the demand for this class of apparatus, the Witton

Fig. 3.—Witton-Kramer Electric Pulley Block.

Kramer Electric Tool & Hoist Works (Proprietors: The General Electric Co., Ltd.) has produced an electric pulley block, features of which are its compactness and lightness. The electrical unit consists of a totally-enclosed motor, with a reversing controller. The drive from the motor shaft is by a set of spur gears, the spur wheel being mounted on the worm shaft of a worm-gear pulley block of ordinary design, specially strengthened for power drive. The load is lifted by means of an electrically-welded chain and sheave block and hook, special care being taken in the manufacture of this to ensure the perfect fitting of the chain in the chain wheel. This equipment, which is made for d.c. voltages up to 480 V, weighs only 2 cwt., and will lift a load of one ton at a speed of 10 ft. per minute. The standard equipment shown in the accompanying illustration (fig. 3) includes a chain for a 10-ft. lifting height.

The "Oliver" Mortising Machine.

The accompanying illustration (fig. 4) shows a vertical-spindle, hollow-chisel mortising machine recently placed on the market by the Oliver Machinery Co., Grand Rapids, Mich., U.S.A. The principal feature of the device is the fact that the motor is mounted directly on the spindle of the machine, being enclosed in the same housing with the spindle and the mechanism of the head. The motor operates on either two- or three-phase, 60-cycle alternating current at a speed of 3,600 r.p.m. The rotor is mounted directly on the machine spindle, which runs in ball bearings. The position of the motor eliminates countershafting, pulleys and belts, and also saves floor space. Since it is self-contained the machine may be given any position in the shop desired, regardless of the position of the line shafting. The maker claims that the drive is very economical in the consumption of power. An enclosed starting switch with fuses is mounted on the machine and connected by a flexible conduit to the motor.

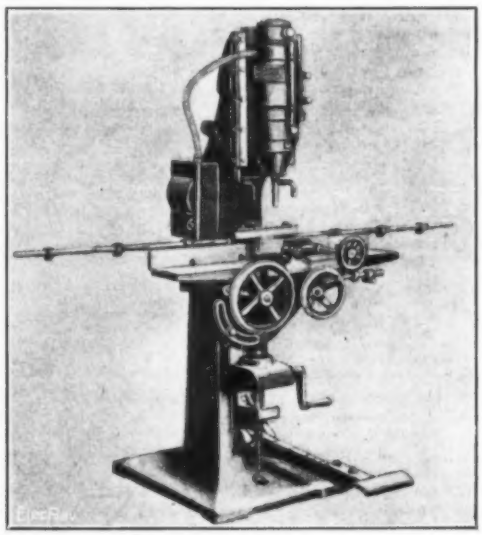


Fig. 4.—The "Oliver" Mortising Machine.

The machine is equipped with a compound table having a feed operated by a handwheel through a rack and pinion and provided with a clamp for the work. The necessary bushings, wrenches and other equipment are provided.—*American Machinist.*

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STANLAND, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

32,107. "Thermionic valves." S. G. Frost. November 30th.
32,122. "Distributors or commutators of electric ignition systems of internal-combustion engines." F. A. Hood. November 30th.
32,139. "Electrical switching or commutating devices." W. A. Price. November 30th.
32,140. "Welding by the electric arc." J. H. Paterson and Premier Electric Welding Co., Ltd. November 30th.
32,159. "Working of telegraph cables." E. S. Heurtley. December 1st.
32,160. "Wireless telegraph receivers." L. B. Turner. December 1st.
32,162. "Sparking-plugs." A. Bernollin. December 1st.
32,173. "Signalling apparatus for mines, &c." G. M. Harvey. December 1st.
32,184. "Gas, electric, &c., heaters." B. Mather. December 1st.
32,188. "Apparatus for cooling electric resistances or electrically-heating fluids." F. B. Cox. December 1st.
32,211. "Electric fuses." J. J. J. M. Kluijtmans and Phi-Kappa Syndicate, Ltd. December 1st.
32,212. "Electric heaters, &c., and commutators, &c., for use therewith." Phi-Kappa Syndicate, Ltd., and D. Watson. December 1st.
32,223. "Signalling devices for tramway, &c., systems." L. H. Smith. December 1st.
32,236. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd., (Westinghouse Electric and Manufacturing Co.). December 1st.
32,241. "Electro-magnetic devices for heavy-current switches." Civilingenieure Seyfferth & Hansen Ges. December 1st. (Germany, December 6th, 1920.)
32,242. "Cable-winding reels." R. D. Stowell and Wayne Engineering and Equipment Co., Ltd. December 1st.
32,252. "Electric heaters." W. Bryan. December 1st.
32,253. "Electric heaters." W. Bryan. December 1st.
32,254. "Electric heaters." W. Bryan. December 1st.
32,255. "Adjustable electric heaters." W. Bryan. December 1st.
32,277. "Electrodes for soldering and depositing metals." Alloy Welding Processes, Ltd., and E. H. Jones. December 1st.
32,291. "Burglar alarm." F. E. Wood. December 2nd.
32,321. "Electric control systems and switch mechanism therefor." R. Amberton. December 2nd.
32,322. "Sparking-plug." D. Fraser. December 2nd.
32,338. "Adjustable bracket for electric-lamp holders, &c." F. G. Carter. December 2nd.
32,342. "System of electric lighting in combination with piano, &c." J. A. Taylor. December 2nd.
32,352. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. December 2nd. (United States, December 2nd, 1920.)
32,354. "Fuse boxes." W. Preston. December 2nd.
32,363. "Thermionic generators." Ges. fur Drahtlose Telegraphie. December 2nd. (Germany, December 3rd, 1920.)
32,364. "Generation of electrical oscillations by thermionic valves." Ges. fur Drahtlose Telegraphie. December 2nd. (Germany, December 4th, 1920.)
32,365. "Calling-apparatus for high-frquency telegraphy." Ges. fur Drahtlose Telegraphie. December 2nd. (Germany, December 4th, 1920.)
32,377. "Apparatus for preventing occurrence of higher harmonic currents in working of metal-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. December 2nd. (Switzerland, December 6th, 1920.)
32,380. "Systems of electric motor control." British Thomson-Houston Co., Ltd., and H. F. Farmer. December 2nd.
32,381. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). December 2nd.
32,385. "Means for coupling electric leads to terminals." E. J. Detmold. December 2nd.
32,386. "Electrical terminals, adaptors, &c." E. J. Detmold. December 2nd.
32,390. "Working cross-current re-cooling devices." C. Kohler. December 2nd. (Switzerland, December 27th, 1920.)
32,421. "Vacuum, &c., tubes, &c., for electrical discharges." A. H. S. Colebrooke and W. A. Williams. December 3rd.
32,422. "Electric-motor control systems." A. H. Jackson. December 3rd.
32,447. "Automatic electric welding-machines." E. G. Budd Manufacturing Co. December 3rd. (United States, December 13th, 1920.)
32,482. "Fuse blocks." L. Bertram. December 3rd. (France, January 19th.)
32,489. "Spark-intensifiers and ignition controllers for internal-combustion engines." E. E. Lehwess. December 3rd.
32,493. "Dynamo-electric machines." C. A. Vandervell and C. A. Vandervell & Co., Ltd. December 3rd.
32,499. "Means for varying intensity of illumination of road-vehicle electric lamps." J. H. Runbaken and W. Torrance. December 3rd.
32,501. "Indicator systems for lifts, &c." Sterling Telephone & Electric Co. Ltd. December 3rd.
32,502. "High-frequency telephony." H. Sefton-Jones (Lorenz Akt.-Ges.). December 3rd.
32,523. "Electric current generator." K. Roller December 5th. (Germany, December 4th, 1920.)
32,527. "Driving mechanism of electric generators." E. B. Collingham and C. J. A. Owen. December 5th.
32,530. "Electric heaters for internal-combustion engines." S. B. Depree and J. B. Hoker. December 5th.
32,545. "Sparking plugs." W. Pickard. December 5th.
32,549. "Combined electric heating and lighting apparatus." K. Beresford. December 5th.
32,580. "Wireless telegraphy antennæ." W. Dornig. December 5th.
32,583. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). December 5th.
32,595. "Method of driving machine tools with independent electrical drives." H. Becker and Maschinenfabrik Schiess Akt. Ges. December 5th. (Germany, December 6th, 1920.)
32,596. "Anti-climbing devices for posts carrying electric wires, &c." P. G. Mitchell. December 5th.
32,597. "Electric train control systems." J. B. Regan. December 5th.
32,598. "Vacuum valves for train control systems." J. B. Regan. December 5th.
32,621. "Thermostatically-controlled socket switches." Shawmut Machine Works, Inc. December 5th. (United States, December 3rd, 1920.)
32,628. "Electric pianoforte driers." P. Watson. December 6th.
32,657. "Vacuum tubes." E. Y. Robinson. December 6th.
32,693. "Heating devices and electric furnaces." T. Charlier. December 6th.
32,715. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. December 6th.
32,716. "Electric lamp fittings." British Thomson-Houston Co., Ltd. (General Electric Co.). December 6th.
32,725. "Fastening transformers in their oil tanks." Ferranti, Ltd., and V. Z. de Ferranti. December 6th.
32,726. "Supporting devices for transformers, &c." Ferranti, Ltd., and S. Z. de Ferranti. December 6th.
32,732. "Method of installing turbines for driving dynamos." Akt. Ges. Brown, Boveri et Cie. December 6th. (Switzerland, June 7th.)
32,780. "Electric switches and contacts." H. S. Cooke and A. G. Sutherland, Ltd. December 7th.
32,805. "Dimming switch for lighting system of automobiles." W. F. Benton and G. Degge. December 7th.
32,808. "Dimmer switches for head lights of motor cycles, &c." G. Arthur, W. F. Hardy, and R. R. Sprosen. December 7th.
32,844. "Receivers for sound waves in liquids." Signal Ges. December 7th. (Germany, December 7th, 1920.)
32,846. "Power generators and transmitters." G. G. Lemons. December 7th.
32,856. "X-ray screen." C. A. Cooper and M. Maxwell. December 7th.
32,872. "Wireless telegraph receiving apparatus." A. W. Langridge and N. W. McLachlan. December 7th.
32,874. "Electric radiators." W. Bryan. December 7th.
32,875. "Multi-pole electric switch." C. A. M. Buckley. December 7th.
32,876. "Electric starting motor for internal-combustion engines." C. A. M. Buckley. December 7th.
32,890. "Head-lights, &c." F. G. Piper. December 7th.
32,892. "Measurement of alternating voltages." E. B. Moullin. December 7th.
32,893. "Electric light bulbs." J. F. Lymburn. December 8th.
32,904. "Magnetos." H. Lewis. December 8th.
32,917. "Electric torches." S. A. Fox. December 8th.
32,930. "Electric incandescent lamps." E. Rohner and E. Simic. December 8th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

13,909. "Jigs for use in electrically welding the parts of automobile bodies." J. Ledwinka. May 20th, 1920. (171,716.)
13,968. "Apparatus for detecting or translating electrical impulses." Radio Communication Co., Ltd., and J. Scott-Taggart. May 20th, 1920. (171,717.)
16,632. "Electric driving of ship propellers." Siemens Schuckertwerke Ges. August 1st, 1916. (145,469.)
19,813. "Dynamo-electric machines." V. G. Apple. April 23rd, 1917. (147,785.)
20,964. "Process and connection for obtaining a strengthening of wireless messages." Dr. E. F. Huth Ges. and Dr. S. Loewe. June 11th, 1917. (149,217.)
21,095. "Automatic stopping device for talking machines of all kinds worked by electric motor." A. Ebner. July 12th, 1920. (Convention date not granted.) (149,664.)
21,699. "Battery filling machines." L. A. Freedman. July 19th, 1920. (171,737.)
21,893. "Synchronous motors for mechanical loads." Siemens Schuckertwerke Ges. July 21st, 1919. (171,412.)
22,360. "Apparatus for the production by electrolysis of gas under pressure." E. Vesme. July 26th, 1920. (171,743.)
23,860. "Frequency filters." British Thomson-Houston Co., Ltd., R. C. Clinker, and F. W. Carter. August 16th, 1920. (171,752.)
23,978. "Electric switches." H. B. Prentice. August 17th, 1920. (171,756.)
24,263. "Vibration apparatus particularly for the reception and production of sound waves." Signal Ges. August 21st, 1919. (150,322.)
24,275. "Regulating resistances composed of contact pressure elements with spring pressing mechanism." Akt. Ges. Brown, Boveri et Cie. August 26th, 1919. (150,323.)
24,451. "Machine for the generation of electric currents also applicable as a motor." A. Young. August 23rd, 1920. (Addition to 127,488.) (171,782.)
24,753. "Electrical systems of automatic sub-stations." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 26th, 1920. (171,795.)
24,754. "Automatic electrical sub-station systems." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). August 26th, 1920. (171,796.)
24,837. "Electric rheostats." Wilson Welder and Metals Co. Inc. May 7th, 1920. (163,021.)
25,444. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). September 3rd, 1920. (171,808.)
25,447. "Ignition magnetos." Soc. Anon. La Magneto Belge. September 3rd, 1919. (150,729.)
25,465. "Polarised relay for use in controlling rotary converters." Metropolitan-Vickers Electrical Co., Ltd. (Westinghouse Electric and Manufacturing Co.). September 3rd, 1920. (171,809.)
26,344. "Charging boards for electrical batteries." W. T. Coulson and Optalyte, Ltd. September 14th, 1920. (171,823.)
26,595. "Terminal protectors for sparking plugs." Sphinx Manufacturing Co., Ltd., and W. A. Clark. September 17th, 1920. (171,829.)
26,808. "Electric transformers and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). September 20th, 1920. (171,836.)
27,104. "Motor control systems for electric lifts and the like." Waygood Otis, Ltd. (Otis Elevator Co.). September 23rd, 1920. (171,846.)
27,396. "Arrangements for detecting the position of points in railway systems." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. September 27th, 1920. (171,848.)
27,478. "Automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. January 28th, 1920. (158,222.)
27,509. "Electric irons that are fitted with a power's-on indicator." G. H. Lofts. September 28th, 1920. (171,850.)
28,199. "Operating mechanism for searchlights, guns, and the like." British Thomson-Houston Co., Ltd. (General Electric Co.). October 5th, 1920. (171,857.)
28,520. "Magnetic separators." H. H. Thompson and A. E. Davies. October 8th, 1920. (171,859.)
29,091. "Process and apparatus for regulating the direct-current voltage in metal vapour rectifier installations." Akt. Ges. Brown, Boveri et Cie. October 14th, 1919. (152,361.)
29,319. "Brush holder for dynamo-electric machinery." British Electric Plant Co., Ltd., and I. N. Whitesmith. October 16th, 1920. (171,870.)
29,844. "Electric switches." O. Oldham, G. Oldham, and J. Oldham. October 21st, 1920. (Cognate aplication 19,097/21.) (171,878.)
31,147. "Arc generators for producing oscillating current of high frequency." P. O. Pedersen. August 5th, 1920. (167,445.)
31,536. "Electric reactors." S. R. Bergman. June 24th, 1920. (165,433.)
32,992. "Insulation of electric overhead lines." H. F. Tessmann and R. C. Horn. November 23rd, 1920. (171,900.)
33,649. "Electric motor control systems." British Thomson-Houston Co., Ltd. (General Electric Co.). November 29th, 1920. (171,904.)
33,874. "Electric resistance welding." R. F. Woodburn. December 1st, 1920. (171,906.)
34,117. "Electrolytes for use in electrolytic cells." Metropolitan-Vickers Electrical Co., Ltd. December 9th, 1919. (155,579.)
34,726. "Regulating systems for electric circuits." British Thomson-Houston Co., Ltd. (General Electric Co.). December 8th, 1920. (171,911.)
36,165. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. December 27th, 1919. (Patent of addition not granted.) (155,833.)

1921.

229. "Hydraulic telemotor apparatus." G. R. Ranzi. January 4th, 1921. (171,919.)
959. "Electric resistances." H. Behn (*née* Eplinius). January 3rd, 1916. (157,104.)
1,291. "Accumulator plates." L. de M. Cattley. January 10th, 1921. (171,921.)
7,425. "Process of electrolytically separating chromium." E. Liebreich. March 8th, 1920. (159,867.)